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CARCINOMA IN OSTEOMYELITIS

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THAT carcinoma may develop in old ulcers and sinuses has been known for about a hundred years but little has been written about the subject recently.

To Marjolin in 1828 must go the credit for having first recognized malignant changes in old ulcers but whether or not he described carcinoma in old sinuses is uncertain.¹ According to Boegehold Marjolin designated such malignant change as warty ulcer.

Caesar Hawkins, surgeon to St. George's Hospital in London, read a paper in 1823 entitled "Cases of Warty Tumors in Cicatrices." He reported 7 cases, most of them arising from burns, flogging or other deep scars. One case, however, seems quite definitely to have followed osteomyelitis. The record was as follows:

James Calcott, aet. 49, was admitted into St. George's Hospital, May 6, 1828, under the care of Sir Benjamin Brodie.

He had a yellow wart like fungus about the size of a crown piece which rose above the skin and through which some bone was felt. This was situated in the center of some old cicatrices. He had received a blow on the shin from an anchor 27 years previous to his admission which was followed by a large abscess out of which some dead bone had been taken while in a naval hospital after which the wound healed. Fourteen months ago he received another injury which was also succeeded by an abscess at the bottom of which the bone was exposed. The exposed bone was believed to be dead but as it was not loose he left the hospital until it was in a fit

state to be removed soon after the fungus formed and he was readmitted when the tumor seemed to be connected with the bone or the periosteum or both.

June 5th the tumor being removed with the periosteum to which it was fixed a portion of the bone which seemed to be more vascular than usual was taken away with the trephine so as to expose the medullary canal. The vascularity did not extend more than a quarter of an inch in depth and the bone was not otherwise altered. The wound healed well and the man has since continued free from disease.

This history corresponds closely to many subsequently reported and to those in this series. As to the prognosis of such warty tumors Hawkins was most sanguine, quieting his own and his patient's anxiety by a confident assurance that the disease is not in the least malignant as cancer is malignant but on the contrary entirely local in its origin and does not contaminate even the adjacent parts except in a very trifling degree, so that no future mischief need be apprehended. Although such a particularly favorable prognosis is probably not justified it is generally recognized that carcinoma developing in scars or sinuses is usually of low grade malignancy.

The next case is that reported by Dittrich in 1847. The patient was a man of 38, who had suffered from necrosis of the tibia for 20 years. A thigh amputation was performed. The lesion involved the lower three fourths of the tibia. The specimen was examined by Professor Rokitsky who confirmed the diagnosis.

Mr. J. L. W. D. D. M. F. S. S. M. T. B. D.
in B. t. W. sh. gt.

of carcinoma. He found epithelial cells growing down the sinus tract deep into the cavity of the bone. Although he could find no macroscopic evidence of cancer at the mouth of the sinus, he believed it probable that epithelial cells had grown in from the surface and had caused the disease. This is in accord with our present belief, it being not at all uncommon to find malignant epithelial cells at the mouth of the sinus extending deep into the cavity.

In the next 40 or 50 years quite a few cases of cancer in osteomyelitis were reported among them cases by Hannover (1853), Cornil and Ranvier (1866), Winwater (1878), Nicoladini (1881), Fischer (1881), Esmarch, Volkmann (1889), Van Hook (1890), and Feigel (1891).

In 1891 Borchers collected a series of 10 cases from the literature and added 5 from records and patient under his observation. Of the 25 cases collected 14 followed acute osteomyelitis, but the others may have been tuberculosis. Borchers noted that metastasis was rare; in none of his cases were there metastases beyond the regional lymph nodes. He saw many patients well several years after amputation.

In 1894 von Friedlander reported 3 cases. In the same year Devars collected a series of 39 cases. He noted how very much more frequently the tibia was involved than any other bone, 26 times out of 39 cases. Of the other bones the femur was affected five times, the bones of the foot five times, the arm twice, and the knee once. He also noted as is the case in this series, two very different clinical varieties of the disease. Sometimes he writes there exists in the nearby skin a more or less extensive cancerous ulcer which puts one at once on the track of the diagnosis; at other times on the contrary the lesion is produced deep within the tissues, there is no trace of epithelioma at the level of the fistula, and it is then that only a complete examination, noting the peculiar foulness of the discharge, can put one on the track of the diagnosis. Devars found involvement of the lymph glands in many cases, a finding which does not seem to be substantiated by most authorities or by our own series.

During the next 10 years, from 1894 to 1904, there was much interest in the subject, judging from the number of cases reported. Cone

in 1897 reported 2 cases with special reference to the pathological findings. In 1898 Verdet reported a case involving the fibula. In 1899 Crutchet and Lanelongue each reported cases. Cargue and Bauby in 1902 and Guot in 1904 wrote very good dissertations on the subject with reviews of the literature, case reports and general discussions of the course and treatment of the disease. In 1903 Sherrill reported a case, noting its slow progress and advising amputation.

From that time up to the present there has been almost nothing written about cancer in osteomyelitis, with the exception of case reports by Mathieu and Khan in 1920, by Hitzrot in 1921, and by Vernengo in 1928. Amputation was necessary in all these cases. Vernengo urged as a prophylactic measure that every effort be made to cure fistulae in bone.

Our interest in this subject has been recently stimulated by the occurrence of the following case:

CASE 1. P, a single man of 58 years (E. S. No. 305300) entered the hospital on March 12, 1930, because of pain in the left knee of about 20 years' duration. Twenty years ago he had been prostrated with swelling and pain in both legs, after which motion had been limited in both knees. A sinus in the left thigh had been discharging pus almost continuously for the entire 20 years.

Physical examination showed both femora and tibiae greatly thickened with nearly complete ankylosis of both knees. Along the lateral aspect of the distal portion of the left thigh were two large sinuses draining foul purulent material. X-ray examination showed chronic osteomyelitis of the left femur and both tibiae. Incision and debridement of the left femur was done a few days after admission and revealed an enormous necrotic cavity containing very friable and polykymatous material. Pathological report showed chronic osteomyelitis and epidermoid carcinoma, grade I.

Accordingly, in view of the extent and character of the disease in the left femur, a hip joint disarticulation was decided upon and performed by Dr. R. H. Sweet about 2 weeks after admission, following which the patient made a successful recovery.

This case, one of the few in our series in which carcinoma was not suspected before operation and even in this case there was a slight epithelial hyperplasia at the sinus opening (Fig. 1), which subsequent examination showed to be carcinoma. The gross appearance of the cavity and sinus is shown in the accompanying illustrations (Figs. 1 and 2).

After disarticulation of the femur and tibia, respectively gradually showing the extent of the disease (Fig. 3 and 4). In spite of the most careful X-ray pictures taken both before and after disarticulation



Fig 1

Fig 2

Fig 1 Sinus opening shows definite epithelial hyperplasia. Clinically suspicious of carcinoma. Microscopic examination showed epidermoid carcinoma. Case 1.

Fig 2 General view of sinus after curettage showing friable necrotic material at base. Case 1.

Fig 3 Appearance of cavity after plating the femur. Probe inserted in sinus tract. Carcinoma lining nearly



Fig 3

Fig 4

the entire cavity and infiltrating the bone in some places to a depth of an inch and a half. Case 1.

Fig 4 General appearance of platted femur and tibia. The dark area at the upper end of the femur is merely hemorrhagic bone marrow. The probe is inserted in the carcinoma osteomyelitis cavity. The tibia shows only osteomyelitis. Case 1.

it was impossible to discover anything definite in the plates which would have led to a diagnosis of carcinoma (Figs 5 and 6).

On searching the hospital records 10 other cases were discovered in 5 of which the carcinoma was obvious on physical examination and amputation was performed in every case. The following are summaries of these 5 cases.

CASE 2. O. M., a man of 61 years (S. R. Vol 377 p. 16) entered the hospital on June 10, 1901, because of pain in the left leg. He had been more or less of a cripple all his life, his left foot having become swollen at the age of 4 years and having been filled with discharging sinuses since childhood. Examination showed the left foot to be one mass of foul ulcer from which as a base grows a cauliflower mass. Tibia up to upper third is thickened and shows several scars of old sinuses.

Amputation one inch below the knee was performed 2 days later by Dr. S. J. Mixer under ether anesthesia. The following day it was necessary to open the stump to control a postoperative hemorrhage. Although the wound did well the patient ran a septic temperature without apparent cause, finally developing a hypostatic pneumonia from which he died 30 days after operation.

Pathological report showed papillary epidermoid carcinoma of the leg and ankle.

This is the only immediate mortality in the series and death apparently was due entirely to the complicating pneumonia.

CASE 3. A. W. M., a widower of 50 years (T. S. No. 144424) entered the hospital on September 19, 1905, because of a sore on his left leg which had been present for the past 36 years, since the patient had typhoid fever at the age of 14. The sore had never completely healed and had discharged dead bone at times ever since the onset. About 2 years before entry he had received a blow on this sore spot, since which time he had been unable to work, and the leg had discharged continually. Physical examination showed at the upper third of the left tibia a sloughing dirty sore covering the whole front of the leg with a mass in the center the size of a small plum. The day after admission a mid thigh amputation was performed by Dr. R. B. Greenough and 10 days later the groin was dissected. Pathological report showed epithelioma of leg, the glands from the groin being negative. Convalescence was uneventful. One year later he was examined and found to have a perfect result.

CASE 4. W. H. B., a widower of 75 years (E. S. No. 154748) entered on August 2, 1907, because of pain in the left lower leg and lameness of 6 months duration. When 11 years old he had had a fever sore on his leg which had been lanced and pieces of bone had been removed. After a period of alternate healing and breaking down it had remained healed for 25 years. It then broke open again and bone fragments were again discharged a year and a half before admission. Examination (Fig. 7) showed a cauliflower reddish mass with a foul discharge involving almost the whole anterior surface of the left lower leg. A few days after admission a low thigh amputation was performed by Dr. Hugh Williams. The pathological examination showed



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formel ly Dr Beth Vincent a fe d ys after a l
mi n sc i th loo p of a right inguinal gland
After scopic examination of the tumor sh we l
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The lymph node s neg tve The patient mal
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sepsis an l some hat p inul amputation stump
l years later he was examined in the tumor
clnic wher no evlence of recurrence could be
note l

note 1
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man of 20 years (W S \ 1 307 p 98) enter
through the Emergency Warl on December 21
1895 because of a crushed right foot the injury

having been caused by the door of a street car a few hours previously. Examination showed the skin on the dorsum of the foot entirely dissected off a compound fracture of the fifth metatarsal and lacerations and crushing of the soft parts. After a long and somewhat stormy convalescence the patient was discharged well on February 12 1896 the only surgical procedures having been antiseptic dressings and skin graft.

Second admission Thirty years later December 2 1925 patient was again admitted (W S No 273376) giving a history that his foot never had healed entirely since his accident and that 5 years after he left the hospital it began discharging pieces of dead bone with constant festering. Examination showed a proliferating ulcerated growth occupying the instep and most of the plantar surface of the right foot (Fig 8). A clinical diagnosis of carcinoma was made. A few days later amputation of the right lower leg was done by Dr J C White 3 weeks after which he was walking about on crutches and feeling very well. Pathological report showed squamous cell carcinoma grade I December 4 1928 the patient was seen in the tumor clinic. There was no sign of recurrence.

In the 5 other cases found in the records of this hospital the diagnosis and treatment were slightly different in each case in 2 cases biopsy or excision being resorted to in order to establish the diagnosis and in other cases in spite of a positive diagnosis of cancer amputation not being considered necessary. In Case 11 incision and drainage and failure to heal led to a secondary operation when pathological fracture occurred followed later by amputation.

CASE 7 G A D a married white man of 4 years (W S No 130621) entered the hospital January 16 1903 because of a discharging sinus in the right lower leg dating from an operation for osteomyelitis when he was 10 years old. There had been many exacerbations but about 3 months before admission the pain became very intense he had to give up work and he noticed a small growth appearing at the old sinus. Examination showed a diffuse tender enlargement of the ankle with three discharging sinuses just above it and a round ulcerating growth discharging foul material around the upper sinus. Biopsy of this ulcer showed it to be an epithelioma.

Amputation of the leg through the femoral condyles was performed by Dr J C Warren the day after admission after which the patient made a satisfactory though somewhat stormy recovery.

CASE 8 First admission T P C a widower of 53 years (L S No 133503) entered March 19 1903 because of a sinus of the left lower leg discharging pus and pieces of bone off and on since the patient was 2 years old. Examination showed on the left lower leg toward the inner side and midway between



Fig 7 left Appearance of leg on admission. Diagnosis of carcinoma in osteomyelitis evident on history and inspection. Case 4.

Fig 8 Two years showing extensive malignant growth of instep. Case 6.

the tibial tubercle and the malleoli an irregular sloughing area surrounded by granulations. There was a moderate discharge coming from the tibia which was exposed and considerably thickened. Carcinoma was suspected. Operation was performed by Dr C A Porter 2 days after admission the area widely excised and the bone chiselled away. Microscopic examination showed epithelioma. About 2 weeks later the patient was discharged with a clean granulating wound.

Second admission Six weeks after discharge the patient returned because of a bright erythema about the inner side of the granulating wound on the leg suggesting erysipelas. After 2 weeks in the hospital the erythema subsided and the patient was discharged there still being present a sluggish granulating area.

Third admission Two months later he was again admitted for treatment of the ulcer of his left lower leg. A low thigh amputation was performed by Dr C L Scudder microscopic examination again showing epithelioma. Convalescence was uneventful. Eight years later he was seen and found to have had no recurrence.

In the 2 following cases a local removal of the growth without amputation was considered sufficient.

CASE 9 W H L a married man of 46 years (T S No 283779) entered the hospital on May 24 1927 with a chief complaint of abscess of the right



Fig 9

Fig 10

Fig 9 Anteroposterior X-ray of tibia and fibula showing extensive osteomyelitis. The re-
 mated part is distended between the two rows. Case 9
 Fig 10 X-ray post-operative about 6 weeks after operation showing good bony remodeling.
 post-operative Case 9

shin. He had been operated upon 5 months before at a local hospital for an ulcer of the leg which had been discharging pus for an unstated period of time. Following operation the lesion instead of healing grew progressively worse and the patient lost 11 pounds in eight months. Physical examination showed the lower third of the right tibia anteriorly a fungating irregular lesion with a sloping center and raised borders surrounded by a blue indurated skin the center center being about 4 centimeters in diameter and apparently involving the bone. The X-ray (Fig 9) was reported as follows: The bones of the tibia are increased in size and irregular in shape. The cortex is thin and shows marked variation in density. In the midportion is an irregular area of diminished density with a line running through it suggesting a fracture line. Such an appearance could be due to old osteomyelitis. No evidence of activity.

Operation was performed by Dr F. M. Dalan 12 days after admission the pre-operative diagnosis being carcinoma in scar of osteomyelitis. The incisions were carried around the growth and close to bone and showed the carcinoma involving bone. The carcinomatous bone was chiseled away and an area of chronic osteomyelitis was drained.

Pathological examination showed a large ragged ulcer 6 centimeters in greatest diameter with fragments of bone adherent to its under surface squamous cell carcinoma group II.

X-rays taken about 6 weeks after operation (Fig 10) were reported as follows: The patient has apparently been operated on since the last observation. Apparent removal of a portion of the bone in the anterior and medial portion of the tibia. The entire tibia shows osteoporosis and some thickening of the cortex may be due to old inflammatory process.



Fig 11 Pre operative X ray pictures The irregular worm eaten area indicated between the arrows is typical of malignancy Case 1

Fig 12 X ray pictures taken at the time of the pathological fracture showing prosthesis of the lesion Case 11

The wound healed well with Dakin's dressings and a skin graft was applied a month later the patient being discharged about 3 weeks thereafter

The patient's condition was followed in the tumor clinic where 3 years later there was no evidence of recurrence either clinically or by X ray The wound had remained well healed for 1½ years and the patient had had complete use of the leg

CASE 10 A C P a single white male of 58 years (W S No 226319) entered the hospital November 5 1918 because of a sore left heel of 12 years duration which would nearly heal but would then break down and cause pain and lameness necessitating the use of crutches Physical examination showed a granulating sluggish ulcerated area on the left heel about 2 centimeters in diameter X ray examination showed a marked irregularity and roughening on the under surface of the os calcis There was also considerable increased density in that region The appearance was that of chronic

osteomyelitis without evidence of malignancy Operation was performed a few days later by Dr C C Simmons the growth being excised and a skin flap swung over the heel from the outer side of the foot Microscopic examination showed the corium invaded by an interlacing network of atypical epithelial cells with abundant small round cell infiltration carcinoma Seven weeks later after two skin grafts the patient was discharged relieved

In the following case carcinoma was not definitely diagnosed until a pathological fracture occurred on the operating table at which time both the X ray and microscopic findings showed carcinoma

CASE 11 L B a single white male of 34 years (W S No 278625) entered the hospital on September 10 1926 the chief complaint being pain in the right leg dating back 30 years to a painful swelling



Fig. 13. Left. Appearance of the leg. Fig. 14. Right. Appearance of the leg. The tumor is visible on the leg.

of the leg which required operation when the patient was only 4 years old. Seven operations were performed in the next 16 years with a discharging sinus ever since the last operation. Examination also showed a large area of broken skin 5 centimeters above the right ankle in which necrotic tissue was plainly evident. X-ray (Fig. 11) taken September 13, 1935 reported as atypical and no positive conclusions were drawn from it.

Operation was performed 14 days after a missed menstruation. The patient was in good health and curettage was performed. Three weeks later it was noted that the sinus was not cleaning up and the necrotic bone seemed to be tenacious. Accidentally biopsy was performed on October 1, during which operation the patient sustained a pathologic fracture at the point of the lesion. Microscopic examination of the tissue showed epidermal carcinoma. X-ray examination (Fig. 12) at this time was reported to be characteristic of malignancy. Amputation just below the knee with reference to the stump was carried out a few days later by Dr. J. W. Spellman, the patient making an uneventful recovery.

Eight months later he was examined in the Outpatient Department and was found to have no recurrence. His condition was followed thereafter in the tumor clinic. At the last examination August 6, 1939, there was no evidence of recurrence of the disease though there was apparently a neuroma in the stump. A letter received June 1930, indicated the patient's condition.

Since the first preparation of this paper there has occurred another similar case which is sum-

marized herewith. In some respects it is the most interesting case of all particularly in regard to diagnosis for although we were alert clinically to the likelihood of carcinoma it was difficult by X-ray and even by biopsy to establish a positive diagnosis.

Case 12. *Isolated sinus in the leg.* A boy 16 years (W. S. Vol. 147, p. 180) entered the hospital on October 5, 1931, because of swelling of the left leg of 1 year's duration. Inflammation had increased without known cause during the past year until constitutional symptoms developed. Sinuses at length became established over the tibia through which the bone appeared. Examination showed some limitation of motion of the knee joint and of the sinus connected with the ankle joint. Ten days after admission operation was performed by Dr. R. M. Hedges. Angiogram was made over the crest of the tibia nearly the whole of the shaft and a portion of the lower epiphysis were found necrotic and were removed after gouging out the anterior wall of the bone. The patient made an uneventful convalescence and was discharged well only 6 days after the operation. Diagnosis: necrosis of bone.

Case 13. *Isolated sinus in the leg.* Fifty-nine years later when he was 65 years of age he was admitted to the hospital (F. S. No. 30695) because of pain in the left lower leg and a discharging sinus. Since his previous illness he had been occasionally leprous when a small sinus had opened with slight discharge and the appearance of small pieces of bone. On the whole however the leg had healed him very little until 6 months ago when he was struck on the left shin after which a sinus developed and kept increasing in size. Recently there had been so much pain and foul discharge that his leg had been of little use to him. Examination on admission (Fig. 13) showed a sinus 8 centimeters long and about 2 centimeters deep in the anterior lower third of the left tibia discharging a very foul watery material. Because of the very long history and an extremely foul appearance of the lesion carcinoma in old osteomyelitis was at once suspected.

X-ray (Fig. 15) showed some of the characteristic of cancer in bone but it was not certain whether the recent bone destruction was due to osteomyelitis or carcinoma.

The first biopsy done soon after admission showed considerable proliferation of the epithelium which was not considered sufficient to justify a diagnosis of carcinoma. The second biopsy however showed epidermoid carcinoma grade I.

In view of the extent of bone involvement both clinically and by X-ray a Crutchfield amputation was decided upon and performed by Dr. R. H. Wallace following which the patient made an uneventful convalescence.

The appearance of the sinus in longitudinal section is shown in the photograph (Fig. 14). There is a

little normal bone remaining near the lesion that it is remarkable that there had been no pathological fracture

Carcinoma is an extremely rare complication of osteomyelitis only 17 cases having been found out of 2400 cases of osteomyelitis treated in the wards of the Massachusetts General Hospital. Although little has been written about it recently the lesion is very well defined and important to recognize. In a large clinic the possibility of its occurrence in any case of long standing osteomyelitis should be borne in mind.

In our experience the disease has been confined entirely to males owing probably to the fact that osteomyelitis is more common in the male sex. The tibia was involved in 8 cases, the foot in 3 and the femur in 1. This does not correspond exactly with the figures of this hospital for the location of osteomyelitis: 16 out of the 2400 cases of osteomyelitis the largest number were in the femur (616) and a much smaller number in the foot (136). The tibia however as is well known is a very common site for osteomyelitis and in this location there were 386 cases 8 of which developed cancer. No cases of cancer were found developing in osteomyelitis of the jaw (267), humerus (190), radius and ulna (106), hand (119) or other scattered locations. Scudder however says that carcinoma sometimes follows in the sinus or edges of old fistulous tracts about the jaws. All of our cases of cancer of the jaw were carefully reviewed and none could be surely traced to an osteomyelitis as their origin. Two cases of cancer of the upper jaw gave histories of chronically infected bone but pointed rather more to an origin in the antrum than to osteomyelitis. It seems reasonable to explain this by supposing first that better circulation of the face and upper extremities tends to more rapid healing in chronic osteomyelitis in these localities and second that many patients would not tolerate foul sinuses on the face or upper extremity for a long enough time to permit the development of cancer. In the leg however the circulation is often poor and patients are apparently willing to neglect very foul lesions for many years. In one case (Case 4) osteomyelitis had been present for 64 years with alternate healing and breaking



FIG. 15. Area indicated between arrows shows the site of carcinoma. The roentgenogram shows some of the characteristics of cancer in bone. Note the extreme calcification of the artery. Case 4.

down of the sinus and discharge of fragments of necrotic bone. In fact the majority of cases give a history of over 30 years duration.

The history and course of the disease in a typical case is somewhat as follows:

A man of middle life or beyond enters the hospital because of foul ulcers or sinuses generally of the lower leg but sometimes of the thigh or foot. In about half the cases pain is a prominent symptom. Not infrequently there is a history of trauma preceding the onset of the osteomyelitis. Usually surrounding the fistulous opening there is a fairly definite cauliflower mass which leads at once to the diagnosis of carcinoma. In some cases however there is no external evidence of malignant disease or in others there may be a slight epithelial overgrowth at the margin of the sinus opening

In all suspicious cases a biopsy should be done and if carcinoma is found there is very good likelihood that the disease has spread inward along the tract and is involving the bone. Where there is no external evidence of malignancy it may be impossible to make the diagnosis until the osteomyelitis cavity is explored at which time either the gross appearance or microscopic examination of frozen sections will lead to the correct diagnosis.

X ray examination of course is made in all cases before operation but it has not been possible in the few cases studied by X ray since the introduction of good apparatus to make the diagnosis of carcinoma in osteomyelitis by X ray alone. The series presented with X ray photographs in 4 cases gives a very good idea of the variation in the X ray findings. Case 1 (Figs 5 and 6) for example showed by X ray very similar lesions of both femur and tibia supposedly both due to osteomyelitis and yet pathologically the tibia showed only osteomyelitis while the femur showed carcinoma as well. On reviewing these X ray films very carefully there are found some areas in the femur which might make one suspect carcinoma. Similarly in Case 12 (Fig 15) the areas of bone destruction might have been due to active osteomyelitis or to carcinoma. In Case 9 however (Figs 9 and 10) the X ray gives no clue whatever as to the presence of carcinoma. Finally in Case 11 (Figs 11 and 12) the X ray appearance is typical of carcinoma and with some knowledge of the patient from a clinical standpoint the roentgenologist should be willing to report definitely carcinoma in osteomyelitis.

The treatment in 9 of these 11 cases was amputation in the 2 others radical excision of the growth locally. As it may be impossible to tell to what extent the carcinoma has invaded the bone in a given case it seems wise to recommend amputation in most cases. If however the X ray film shows very little bone destruction and the carcinoma seems to be merely lining the wall of the cavity a thorough local excision may suffice for this type of cancer usually progresses slowly.

The pathologist may demonstrate that the carcinoma is very superficial or (as in Case 1) that it has invaded the bone to a depth of 1 or

2 inches. In any case it is always of the epidermoid variety indicating that it arises from the epithelium surrounding the sinus and grows inwardly along the wall of the fistulous tract. It seems probable that the chronic irritation to the epithelium from constantly discharging infectious material plays a part in the etiology of this type of carcinoma.

As the disease is ordinarily of the slowly growing epidermoid variety and usually without metastasis in the groin the prognosis under proper treatment is favorable.

CONCLUSIONS

Carcinoma is a rare complication of very long standing osteomyelitis occurring more often in the tibia than in any other bone.

The diagnosis may be very easy when the growth is superficial or very difficult when deep seated in some of the latter cases a diagnosis can be established only by biopsy or rarely perhaps by X ray examination.

The treatment should be first prophylactic in not permitting osteomyelitis sinus to remain open indefinitely and second curative by amputation in most cases.

The prognosis is generally favorable the condition being of slow development and usually of low malignancy.

NOTE.—The author has to express his appreciation to Drs I. L. Richardson, C. W. Holmes, and J. I. Bradley for their criticism and suggestions in the preparation of this paper.

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EXPERIMENTAL REGENERATION OF THE THYROID GLAND

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A. I. A. M. I. 1925, Ching, M. I. L. 1925, 1926, 1927

In a previous paper the writer called attention to changes in the normal thyroid gland of the dog one of which changes is of destructive (Fig. 1) the other of reconstructive character (Figs. 1 and 2). The fact was established that during normal conditions the organ shows a continuous regeneration in order to replace exhausted or destroyed tissue the replacement seems to keep pace with the destruction. Consequently it may be supposed that the process of regeneration will be much more pronounced in the organ in which the amount of normal tissue is suddenly decreased as for instance by the operative removal of a part of the tissue. The physiological destruction and regeneration sometimes proceed very slowly and in such small areas that these processes may easily escape the notice of the observer just as the steady regeneration of the blood or of the superficial layer of the skin remains inconspicuous. For purposes of comparison reference may be made in the myelolymphatic system to the stratum germinativum to the periosteum and to the intima as the respective centers of new formation of blood skin bone and blood vessels. Other analogous examples could be mentioned. All such centers show an increased activity in conditions causing an increased destruction of the specific tissue. Centers of regeneration which may be inconspicuous in the normal course of an organ will become more distinct during the increased necessity for restoring the loss of a large amount of its specific tissue. In view of this fact the study of regeneration in the thyroid gland leads to the consideration of two questions (1) whether restoration of thyroid tissue is possible due to the existence of regeneration centers and (2) whether the groups of small follicles pointed out by the author as the regeneration centers of the normal gland are also the regeneration centers of the gland after a part of the tissue has been removed.

The possibility of regeneration of the thyroid gland has been considered by other authors who agree that such activity takes place in the thyroid gland under experimental conditions. The papers of Huerthle (1894) Crawford and Hartley (1925) Ilse and Lemery (1926) Marine (1926) and Ilse (1927) supply evidence of the regeneration of thyroid tissue. The writer's experiments confirm their conclusions. These investigators however did not compare the conditions in the normal gland with those active in the regenerating gland.

In a group of dogs the ventral half of both lobes of the thyroid gland was removed and studied as described in the writer's previous paper. The dogs were killed after different intervals following the operation and the rest of the thyroid tissue left inside was examined.

The findings in some of the cases are computed in Table I. The number of crosses indicates the relative amount of destruction and regeneration of follicles; the table shows that in the normal tissue regeneration generally keeps step with destruction. The normal balance between the destructive and the regenerative processes in those portions of the gland left in place is modified not only by increased regeneration but also by decreased destruction of the thyroid tissue. The regeneration was followed over a period longer than 5 months.

TABLE I.—FINDINGS THE RELATIVE AMOUNT OF DESTRUCTION AND REGENERATION IS INDICATED BY CROSSES

| N | Days post op | Normal thyroid | | Regeneration | |
|-----|--------------|----------------|----|--------------|----|
| | | Des | R | Des | R |
| 1 | 6 | ++ | ++ | ++ | ++ |
| 2 | 6 | ++ | ++ | ++ | ++ |
| 3 | 6 | ++ | ++ | ++ | ++ |
| 4 | 6 | ++ | ++ | ++ | ++ |
| 5 | 6 | ++ | ++ | ++ | ++ |
| 6 | 6 | ++ | ++ | ++ | ++ |
| 7 | 6 | ++ | ++ | ++ | ++ |
| 8 | 6 | ++ | ++ | ++ | ++ |
| 9 | 6 | ++ | ++ | ++ | ++ |
| 10 | 6 | ++ | ++ | ++ | ++ |
| 11 | 6 | ++ | ++ | ++ | ++ |
| 12 | 6 | ++ | ++ | ++ | ++ |
| 13 | 6 | ++ | ++ | ++ | ++ |
| 14 | 6 | ++ | ++ | ++ | ++ |
| 15 | 6 | ++ | ++ | ++ | ++ |
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| 94 | 6 | ++ | ++ | ++ | ++ |
| 95 | 6 | ++ | ++ | ++ | ++ |
| 96 | 6 | ++ | ++ | ++ | ++ |
| 97 | 6 | ++ | ++ | ++ | ++ |
| 98 | 6 | ++ | ++ | ++ | ++ |
| 99 | 6 | ++ | ++ | ++ | ++ |
| 100 | 6 | ++ | ++ | ++ | ++ |



Fig 1 Photomicrograph of a section through the normal thyroid of a dog (approximately $\times 90$) showing destruction of follicles. *A* Collapsed follicles. *B* disintegrated follicles mingled with colloid. *C* space filled with colloid resulting from the fusion of several follicles. In the left lower corner a normal area.



Fig 2 Photomicrograph of a section through the normal gland of a dog (approximately $\times 90$) showing the regeneration of thyroid tissue probably from persisting embryonic tissue *A* and from disintegrated areas *B* already containing few new follicles.

All the glandular tissue left in place shows typical changes when studied some time after the operation. The amount of destruction of follicles is very much reduced and cannot be found in as many localities as in the normal uninjured organ. It seems that the gland protects itself against further destruction.

However the table shows one case No 4467 which does not conform to the results of the other cases. It is possible—as the study of the sections suggests—that a greater quantity of thyroid tissue was removed in this dog than in the other dogs. May it be that the loss of such tissue was too great to permit a restoration commensurate with the increased demand of colloid by the body—if the view be true that colloid is released from follicles only by their destruction?

In any normal uninjured thyroid gland it was found that the wall of a follicle is not a permanent structure. In time its cells lose their contiguity and become intermingled with colloid. Some of them disintegrate and fuse with the colloid while others especially those at the periphery of such dissociated follicles keep their normal appearance and seem to continue their function. The colloid liberated by the destruction of follicles is probably resorbed by the lymph vessels and carried

away. In other places of the normal thyroid gland there are regions which consist not of follicles with typical lumen and cellular arrangement but of cell groups arranged as solid masses. In such areas small distinct groups of cells are observed which represent the early stages in the new formation of follicles. The development of new follicles from such groups of resting cells compensates

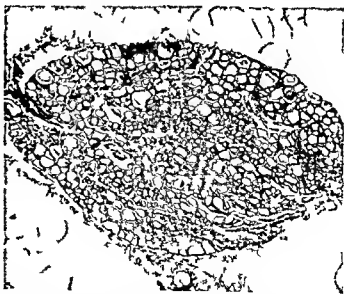


Fig 3 Photomicrograph of a section through the regenerating thyroid gland of a dog 87 days after operation ($\times 15$). Small follicles are characteristic of the regenerating areas; large follicles already present before operation.

COLLATERAL RESPIRATION IN THE LUNG

ROLE IN BRONCHIAL OBSTRUCTION TO PREVENT ATELECTASIS AND TO RESTORE PATENCY¹

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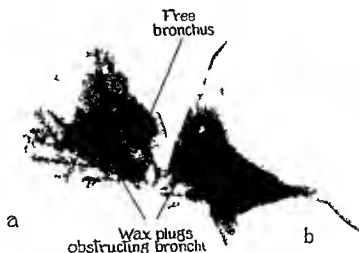
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RECENT investigation of ours² reported elsewhere (3, 4) has shown that the branches of the bronchial tree are interconnected abundantly at the periphery in such manner as to permit gases, thin fluids and particulate matter to pass from one to the other. The connection lies between the fine arborization throughout all parts of a single lobe and it is lacking between lobes that is, it is interlobular and not interlobar.

The present paper deals with the relation of this mechanism to pulmonary function. The experimental findings which are to be reported indicate that it relates especially to bronchial obstruction. Thus, after blockage of one branch or portion of branches in the bronchial tree of a lobe, the corresponding lobule or group of lobules of lung parenchyma

is not necessarily isolated and may continue to breathe by means of the peripheral intercommunications with adjacent unobstructed lobules. In this way the air content of the parenchyma is maintained, atelectasis is prevented and necessary assistance is rendered to the bronchoeliminative functions in expelling the obstruction. We have termed this function collateral respiration by analogy of principle and economic significance to the collateral circulation of the blood vascular system.

In introduction those published observations will be reviewed which indicate the existence of interbronchial communication and are necessary to an understanding of its nature and then collateral respiration and the parts that it plays in pulmonary function will



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be described. Each phase of the subject in turn will first be explained and then illustrated with protocols and other experimental data. All observations presented have been obtained repeatedly, but duplication is to be omitted.

INTERBRONCHIAL COMMUNICATION

Intercommunication between adjacent subdivisions of the airways of the lung was demonstrated most simply by securing a pulmonary lobe of a sufficiently large animal and blowing gently into one bronchial branch. The air after entering and partially inflating the corresponding lobule of the parenchyma escaped from the free bronchi.

Experiment 1 A dog's lungs were obtained immediately after sacrifice and one lobe was removed for testing care being taken in separating it from the others to avoid injury to the parenchyma. Its stem bronchus was then dissected free as far as the first bifurcation and cut off and into each of the two branches was tied a cannula. One cannula was connected to a source of air current and the second was extended to a dish of water where its tip was submerged. A gentle current of air was then started and the lobule supplied by the first cannula was gradually inflated. At a time when inflation was nearly complete and without noticeable inflation of other parts of the lobe air began to bubble from the second cannula. The escape was free. It continued with the injection and accounted entirely for the quantity of air injected. By limiting the rate somewhat the injection could be maintained indefinitely without there resulting complete inflation of the first lobule or any loss of air from the pleural surface. Next the second cannula was closed to retain the air. The remainder of the lobe then began to inflate and inflation progressed in all parts simultaneously precisely as in the first portion. Throughout the process up to full distention appearances of inflation by radial progression from the boundaries of the first lobule were absent as likewise was interstitial emphysema or any other evidence of rupture.

This experiment has been repeated with the same results with specimens from man, dog, cat and rabbit. In the calf and pig however there was found not the slightest interpassage of air even when the pressure of injection was elevated enormously and leakage from the pleural surface and interstitial emphysema were produced. Moreover in all species examined interpassage failed to occur from one pulmonary lobe to another except in certain specimens of man and rabbit and

here pressures too high for any physiological significance had to be used for its accomplishment.

The test was repeated with the intact lungs of living dogs and interbronchial communication was demonstrated—interlobular but not interlobar in type.

Experiment 2 A dog was anesthetized and tracheotomized. A long metal cannula was passed into the trachea and carried to the bronchi on the right side. The cannula was of such design (6) that its end could be forcefully dilated after insertion to secure it in the bronchial lumen with air tight junction and it was thus secured in one bronchial branch of the right lower lobe. A current of air was then passed into the cannula with pressure no greater than 1 centimeter of water and it was found that this could be maintained indefinitely and hundreds of cubic centimeters could be injected without leaving the intrapulmonary pressures increased. Likewise it was found that air could be sucked from the cannula continuously and with equally slight force in unlimited quantities without leaving depression of the intrapulmonary pressures. When however the cannula was loosened with drawn somewhat and resecured so as to fix it in the primary bronchus supplying all parts of the right lower and accessory lobes the results were quite different. Air could be injected into or aspirated from the lung in quantities limited obviously to the capacity of the two lobes and such displacements left marked and persistent changes in the intrapulmonary pressures even when no more than a few cubic centimeters of air were displaced. The dog was sacrificed and the position of the cannula verified. Its junction with the bronchus was tested for security and found to resist vigorous pull as well as very high air pressure and suction.

Certain inferences were drawn from the data concerning the site and mode of interbronchial communication as follows.

The observation in experiment 1 that passage of air from branch to branch of the bronchial tree was obtained only when the parenchyma was somewhat inflated points to the peripheral airways as the site of transfer. The transfer seems not to depend upon artificial channels resulting from overdistention and rupture of the minute airways of one lobule into those of the other for three reasons: namely extremely low air pressures were used (in experiment 1 insufficient to inflate the parenchyma completely and experiment 2 measured at 1 centimeter water or less); a radial pattern of dissemination and emphysema were absent and the transfer occurred

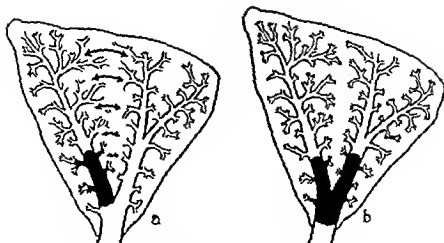


FIG. 1. Diagrams of bronchial trees of two lobes showing collateral forms of structure and arrows path of collateral respiration.

spontaneously in quiet breathing (experiment 1). The appearances of intercommunication as described were explained readily by assuming that the air diffused through the tissue membranes separating the peripheral airways of adjacent pulmonary lobules. It was found however that India ink also accomplished the passage and this pointed to the presence of anatomical openings. These openings may be the pores known to occur in the alveolar walls and believed by some () to exist normally. We have assumed that both diffusion and anatomical continuity operate as far as the transfer of gases was concerned. It seemed likely as well that the absence of air transfer in calf and pig between the main branches of the bronchial tree of the individual lobe and in all species between the airways of two adjacent lobes was due to their separation by connective tissue septa. Indeed these septa were plainly evident. The lung lobes of calf and pig showed the pleural surfaces divided into patches by pronounced septa and the lobules composing the patches could be readily split apart by blunt dissection. Such exaggeration of the division into respiratory units except between the lobes was not seen in the other species.

COLLATERAL RESPIRATION

Experimental results now at hand prove that collateral respiration may be instituted spontaneously and maintained indefinitely

after bronchial obstruction in the living animal. This is shown by direct detection and measurement of the transfer of respiratory gases (alveolar air) to and from a pulmonary lobule the bronchus of which is occluded centrally. The amount of the respiratory displacement is found to be appreciably large, perhaps even normal for the portion of lung concerned. On the other hand no such transfer occurs following obstruction of the stem bronchus of one or more entire lobes.

Experiment 2. A dog was anesthetized and tracheotomized. One bronchial branch of the right lower lobe was cannulated as in experiment 1. The cannula was then connected by rubber tubing to a glass nozzle and the tip of this was submerged in water. This formed a valve permitting the cannulated lobule to expire but not to inspire by way of its bronchus. Air bubbled freely from the nozzle at each expiration and this continued without cessation during a 1 hour period of observation with the total discharge amounting to 1800 cubic centimeters. Then the water valve was rearranged so as to permit inspiration only and in this way was allowed to operate for 1 hour. At each inspiration air passed the valve and entered the cannula in quantity somewhat greater than that which escaped with each breath previously and this continued unabated. Next the cannula was loosened and secured in the primary bronchus supplying the entire right lower and accessory lobes. The water valve was arranged as at first to permit expiration only. Now after two or three breaths and escape of an amount of air approximating that of the tidal air the discharge ceased and did not recur throughout the period (one half hour) of observation. Again the valve was reversed and the capacity of the two

lobes to receive air was found to be similarly limited. The animal was sacrificed and the position and security of the cannula were proved.

Experiments of this sort in which the dog is sacrificed and the lungs examined immediately after completion of a single phase of the procedure show gross alteration in degree of inflation of the cannulated portion of lung only when the position of the cannula is lobar and the type of valve inspiratory. Here the parenchyma is found distinctly emphysematous.

Collateral respiration after blockage of the bronchus of a lobule may be prevented as result of loss of interconnection at the periphery of the lobule. This is found to occur in two ways. Thus exudate and other materials may fill the fine peripheral air passages or alveoli which lie at the boundaries of the lobule and serve as pathways to the points of interconnection as might occur in pulmonary inflammations or there may take place what we believe to be a physiological shut down of these airways. Belief in the latter circumstance is gathered from phenomena observed during the course of experiments of the type of experiment 3 where the animal has been allowed to lapse into deep surgical anaesthesia with shallow respirations for a period before institution of lobular bronchial obstruction. Collateral respiration may then fail to develop and the appearances are those of lobar obstruction and complete isolation of the cannulated part of the lung. A single deep breath on the part of the animal or artificial inflation of the lungs serves to establish collateral respiration and that function then continues without further regard to the depth of breathing.

Experiment 4 A dog was anaesthetized with heavy doses of morphine and ether and was tracheotomized. It lay for 15 or 20 minutes breathing lightly and slowly when the dilatable cannula was introduced and fixed in a bronchial branch of the right lower lobe. The cannula was provided with a valve permitting expiration only. An amount of air was discharged representing that of the tidal air and then no more appeared. After a few minutes the anaesthesia was lightened to allow the animal to breathe more deeply. With the first deep breath air began to escape at expiration and the discharge then continued as long as obstruction was maintained.

PREVENTION OF ATELECTASIS

Collateral respiration has the effect of preventing the formation of atelectasis after bronchial obstruction. Examples are at hand of blockage of bronchi applied for periods varying from 24 hours or less to 2 months without atelectasis where the circumstances are such as to permit of collateral respiration. Thus it proves to be the rule that a plug in the lobular position (Fig. a) with free interconnections at the periphery of the lobule is not followed by atelectasis while a plug in the lobar position (Fig. 2b) may lead to atelectasis. In the former the affected portion of lung is not isolated and in the latter it is.

Experiment 5 A dog was deeply morphinized and a bronchoscope was introduced. Warm soft wax was then carried into the stem bronchus of the accessory lobe and also into one branch of the bronchial tree of the right lower lobe. In each of these locations the wax was pressed in and forced to follow and distend the bronchus and its principal arborizations. The wax soon hardened and formed a tightly fitting mold in the bronchial lumen effectually obstructing it at all phases of respiration. The bronchoscope was withdrawn and the dog was then allowed to sleep off the effects of the morphine. After a period of 3 days it was sacrificed and autopsied. The accessory lobe (lobar obstruction) was found to be solidly atelectatic while the right lower lobe (lobular obstruction) was perfectly normal in all parts as to degree of inflation (Fig. 1 a and b). Both plugs were firmly in place and proved air tight by test with high pressure.

The development of lobular atelectasis after obstruction of the lobular type depends upon closure of the interconnections at the periphery of the lobule and the absence of collateral respiration. These circumstances are produced frequently without intention in experiments with dogs anaesthetized continuously for several hours. Patches of atelectasis appear in unmanipulated parts of the lungs in the cortex and the bronchi which lead directly to them are found to be blocked by accumulated secretion although the obstruction may be limited to the arborizations and evade any but the most painstaking examination. The pattern of its distribution is often quite clearly such as to include the channels along the borders as well as those leading directly to the areas of atelectasis. However, occlusion with secretion of the peripheral interconnec-

tions cannot always be so demonstrated and this is due in part at least to technical difficulty in determining patency of these minute passages. We suspect also that in some cases their closure is due not to obstructing secretion but to physiological shut down developing during the prolonged period of anaesthesia.

RESTORATION OF BRONCHIAL PATENCY

In a systematic study of the aerodynamics of bronchial obstruction to be reported in detail elsewhere the results indicate that collateral respiration may give at times essential aid to the forces of broncho elimination by maintaining a normal volume of air in the lung parenchyma. The action of cough depends directly upon this air. Moreover only that portion of the air present in the lung after the inspiration that precedes the cough which is immediately available for expiration is of service in expelling material from the respiratory tract. We have termed this fraction the available air (3). Actual measurement of the forces exerted by cough to expel a body occluding a bronchus shows that they fail as soon as the available air is absorbed and that this may take place within 30 minutes. In like manner the expelling forces of ciliary and peristaltic activity and drainage by gravity probably also depend upon the presence of a normal content of air in the lung for it is found that as absorption of air occurs after bronchial obstruction and the volume of air is reduced the pressure in the bronchus distal to the point of obstruction falls progressively. This is explained by shrinkage of the lung within its resisting and elastic environs. The pressure very soon lies below that in the bronchus proximal to the obstructing body and this relationship is maintained throughout all phases of respiration no matter how great the effort in respiration may be for both pressures arise alike from the action of the chest wall and diaphragm. Suction is thus developed (seen at -20 centimeters water with the attainment of atelectasis) on the distal side of the obstructing body and this may be expected to act against broncho elimination. Provision is made by the action of collateral respiration

for both of these requirements of the broncho eliminative functions i.e. replenishment of the available air and prevention of suction in the occluded airways.

SUMMARY OF RESULTS

The principle of respiratory mechanics that has been described would appear to have a broad economic significance in the functioning of the lower respiratory tract. Considering the exudative tendency of the bronchial mucosa and the disposition of the lungs to transudation it is likely that obstruction of the smaller air passages occurs frequently. The more minute bronchioles possess no ciliary and little if any peristaltic function to assist in elimination. The lumen of one of these is so small as to be filled over considerable length by no more than a droplet of exudate or secretion and the result of such occlusion would be completely to isolate the corresponding unit of respiratory ducts at the alveoli if there were no peripheral interconnections. Then unless special expiratory effort were soon instituted to make use of the air available for expulsion it would be lost by absorption. Inspiration no matter how forceful would not be able to introduce air past the column of fluid to replace the absorbed air. Atelectasis must soon develop and this lobule of parenchyma must then remain functionless until the exudate undergoes removal by absorption. Under these circumstances a night's sleep for an individual with slight bronchial catarrh would be expected to leave the lungs considerably perhaps seriously handicapped for respiratory space. Indeed a bronchial tree made up of blindly terminating branches would be as inefficient as a blood vascular system consisting of end vessel even more so since respiration operates by ebb and flow rather than by circulation of air and since the forces impelling the air in quiet breathing are comparatively weak. However as it is since the bronchial tree has the function of collateral respiration air is applied to an obstructed lobule as long as the peripheral interconnections remain free and until such time as the block is eliminated by means of sufficiently forceful effort or by absorption.

The experiment (No 5) which illustrates the effect of shallow breathing to prevent the institution of collateral respiration after bronchial obstruction calls to mind the clinical fact that prolonged shallow breathing in patients with excessive bronchial secretion is associated with special tendency to atelectasis particularly in patients recovering from surgical operations. There it is known (1 7) that the lungs are in a state of hypo inflation and we have reason to believe therefore that the effect is to shut down collateral respiration and mechanically to cripple the respiratory mechanism in the disposition of bronchial obstructions and the maintenance of function. Similarly explanation is given for the effects of carbon dioxide inhalations or other means of deepening the respirations in preventing the occurrence of postoperative atelectasis. These maintain the normal degree of pulmonary inflation and thereby help to conserve the function of collateral respiration.

CONCLUSIONS

1 The branches of the bronchial tree in a single lobe of the lung intercommunicate at the periphery in such manner as to permit the transfer from one to another of gases fluids and particulate matter. The process of transfer is referable both to diffusion and to passage through minute openings but this point requires further investigation. The airways of two neighboring lobes do not so communicate.

2 This bears economic significance to respiratory function after bronchial obstruction

for a lobule of lung with centrally obstructed bronchus may yet breathe satisfactorily by using the peripheral interconnections with adjacent free lobules. We term this function collateral respiration.

3 Collateral respiration plays two economic rôles in the lobular form of bronchial obstruction namely that of preventing the development of atelectasis and that of rendering important assistance to the bronchoeliminative forces.

4 Collateral respiration may be excluded by closure of those airways along the margins of the obstructed lobule which have to do with the intercommunication. This may result from blockage with secretions or other materials or from shut down during periods of shallow breathing. The latter circumstance is probably a factor in the pathogenesis of postoperative atelectasis.

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THE ORIGIN OF ENDOMETRIOSIS OF THE OVARY

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In the last decade few conditions have attracted so much attention or have been the subject of so much investigation as have the multiple perforating blood cysts of the ovary. Writings concerning these cysts have been limited almost entirely to the present century and the greatest interest has been evinced comparatively recently nevertheless the volume of literature is astonishing. A number of hypotheses have been submitted but none of these has proved completely satisfactory.

A study of endometriosis of the ovary has led the writer to conclusions which differ radically from most of those which have been reached by other investigators. These appear to be supported sufficiently both by personal observations and the descriptions of other writers and they provide a simple explanation of the origin and many of the characteristics of the cysts. When this study was commenced the writer was thoroughly imbued with the opinion that Sampson's hypothesis left little to be desired (1). It was only after a long study of the ovary itself that difficulties in its acceptance became manifest. Since the numerous hypotheses extant are not completely satisfactory the evidence for this further suggestion is submitted.

HYPOTHESES OF ORIGIN

The hypotheses of origin of the multiple perforating blood cysts may be divided into three main groups

1 Development from embryonal tissues (a) wolffian body or duct (b) the muellerian ducts

2 Postembryonal development (a) from the serosa (b) from lymphatic endothelium

3 Postembryonal displacement of endometrium (a) by way of the fallopian tubes (b) by way of the veins (c) by way of the lymphatics

These various suggestions have been considered so fully by many writers that but little discussion is necessary.

1 The development of tissue from hypothetical cell rests may be disregarded in the presence of more satisfactory suppositions.

The evidence for the development of multiple blood cysts from the serosa—in some cases—is very strong and it seems probable that some examples of the condition e.g. in the umbilicus are of this origin. In the case of the ovary an origin from the surface epithelium (which corresponds with the serosa) is suggested by some observations but these do not explain the majority of the cases.

An origin from lymphatic endothelium is an important suggestion and will be referred to again.

3 In 1921 Sampson (4, 7) described these cysts in a most thorough manner and his work has been responsible for the remarkable popularity of their study. He postulated that they arose by the growth of pieces of endometrial tissue which had become transplanted on to the surface of the ovary having been transported by way of the fallopian tubes. Later he modified this view and described the passage of portions of endometrial tissue along the uterine veins to the ovary.

This work has resulted in the acceptance by many gynecologists of the idea that the cysts dealt with are not only like endometrium but are truly endometrial.

In 1924 Halban added the modification of the passage of tissue by the lymphatics.

In order to explain the preponderance of the blood cysts in the ovary over those of the surrounding peritoneum Sampson (6) regarded the ovarian growths as being the primary developments and the peritoneal cysts as arising from these following their rupture. He postulated an affinity of the ovarian tissue for these endometrial implants stating that the ovary acted as an incubator or hot bed for the pieces of endometrium during their early development.

This hypothesis which was proposed by Sampson has attracted the greatest attention. One cannot but admire the large amount of

energy and ingenuity which has been expended in the elaboration of this idea. The majority of those interested in the subject appear to have wholeheartedly accepted the explanation. There are however a number of difficulties to be overcome and despite this one observes writers regarding the suggestion as fact—or at least intermingling observation and suggestion so that the disentangling of description from hypothesis becomes extremely difficult.

Several important pathological principles must be resurrected before a true appreciation of the nature of the blood cysts can be obtained. They must indeed be disinterred from a mass of philosophical argument concerning primarily morphological resemblances and consequently implantation of tissues spread of viable tissue through the natural passages spread through venous backwaters and concerning statistics of the frequency of the occurrence of blood cysts.

The striking feature of the evidence in favor of the implantation hypothesis is the large number of circumstantial observations (singly of little importance) and the complete absence of anything in the nature of direct proof.

The general laws which must be kept ever to the fore in pathological investigations fall into two main groups.

1. Certain principles have for their support a large mass of evidence accumulated during many generations and these should be applied to observations before the introduction of new or conjectural variations of these principles.

2. Pathological structures should be interpreted in terms of the physiological reactions and embryological character of the tissue in which or from which they arise.

For the explanation of endometrial implantation certain unusual if not unique pathological processes have been invoked.

The implantation of presumably normal adult tissue into other organs of the body where these implants assume an irritative character is surely a departure without precedent from accepted pathological teaching. Of course precedent is unnecessary if the explanation is all sufficing and if therefore

no better suggestion may be made but it is proposed to show that one other point of view, at least should be considered before accepting this less probable origin. The necessity for the introduction of the idea of a 'hot bed' or incubator suggests immediately that some ordinary feature has been overlooked.

The passage of abnormal tissue along natural passages with subsequent implantation on a surface has been described on several occasions though in but few examples can this explanation be regarded as satisfactory. Usually other mechanisms e.g. passage of the tissue by the blood vessels or the lymphatics afford a more probable explanation. All examples of transplantation of tissue (of doubtful viability) through the natural passages should be viewed with extreme caution.

Passage of tissue through the vessels from the uterus to the ovary is difficult of comprehension in the absence of emboli in the lungs in the case of veins or in the lymph nodes in the case of the lymph vessels. In addition a retrograde spread from the uterine vessels into the ovarian veins or lymphatics must be postulated to explain the position of the cysts.

Pathological teaching with regard to the relationships of certain neoplasms to their parent tissues has been emphasized of recent years by the use of such terms as chorionoma, folliculoma, thymoma among many others. Any statement concerning the advisability of the use and multiplication of such terms is unnecessary but the underlying principle is most important. When tissues which will respond in a certain manner to abnormal stimuli are present it seems unnecessary and is indeed undesirable to postulate extraneous material until that of the involved organ has been thoroughly explored.

Any investigation into a disease of the ovary should be preceded by a thorough investigation of the embryology and physiology of that organ.

An axiom that has been overlooked is that morphological and even physiological similarity does not constitute identity. Too readily has it been accepted that the endometrial character of the epithelium of the

perforating chocolate cysts can be concluded with safety from morphological similarity the presence of subepithelial stroma the occurrence of hemorrhage into and around the cysts and the presence of decidual changes in epithelium and stroma during pregnancy.

This conclusion may be attacked from two different points of view.

1. The development of tissues apparently identical with a given type may take place at a distance from the usual site of occurrence of the type tissue without there being any question of transplantation. The development of squamous epithelium in a bronchus or of gastric glands in a gall bladder are excellent examples of the phenomenon. The importance of metaplasia is coming to be appreciated more and more of recent years. This viewpoint is accepted and used by the protagonists of the serosal hypothesis.

Other tissues obviously not endometrial may show the characteristics mentioned. Columnar epithelium indistinguishable by the methods in use from uterine epithelium occurs in ovarian cysts and tumors. A subepithelial stroma is common in many glandular neoplasms not only in the ovary but in other parts of the body. Hemorrhage occurs in cysts other than the endometrial e.g. the luteal cysts. Decidual changes may be found in the subepithelial tissue near the surface of the ovary and decidual cells have been described in the subperitoneal tissue of most of the lower abdominal organs. The writer has observed glands derived from an epithelial downgrowth which showed columnar epithelium and stroma containing decidual cells. The occurrence of this change can be of but little import in the determination of the endometrial origin of the perforating blood cysts.

These propositions will be elaborated further in a subsequent paper.

The *raison d'être* of the foregoing is to demonstrate that the implantation hypothesis at least as far as the ovary is concerned is not on a certain foundation. It is now proposed to show that a different point of attack gives other observations which not only do not conflict with those of other observers but which may be used and co-

ordinated into a useful and simple theory. It is necessary at this stage to review briefly the structure and physiology of the ovary.

MORPHOLOGY AND PHYSIOLOGY OF OVARY

The corpus luteum. The fundamentally important structure in the ovary is the ovum and this cell with its surrounding group of cells—the stratum granulosum—comprises the graafian follicle.

It is the cycle embodying the maturation and retrogression of succeeding generations of these structures which is responsible not only for the physiological changes in the genitalia but also for the many and varied bodies found in the ovary.

Maturation of the graafian follicle is associated with proliferation of the stratum granulosum and a change in the surrounding stroma cells to form the theca interna. The mature follicle consists of a thick stratum granulosum in the center of which is the follicular cavity a layer of swollen epithelium like cells—the theca interna—and a circularly arranged layer of stroma cells described as the theca externa. The ovum is contained in a mass of cells of the stratum granulosum which projects into the follicular cavity—the cumulus.

After migration of the follicle to the surface and rotation of the cumulus rupture of the follicle with escape of the ovum occurs and is followed by a remarkable proliferation of the stratum granulosum the cells of which give rise to the cells of the developing corpus luteum. Cells of the theca interna are in relatively small numbers and form an inconspicuous outer layer.

Hemorrhage occurs into the luteal layer of cells and into the center of the corpus during the stage of vascularization.

Having reached the acme of its development fatty changes occur in the cells and retrogressive alterations result in the gradual replacement of the luteal cells by hyaline tissue. The body thus formed is called the corpus albicans and thus has assumed its final appearance about 9 months after the formation of the corpus luteum. Elaboration of these changes is unnecessary in the presence



Fig 1



Fig 2



Fig 3

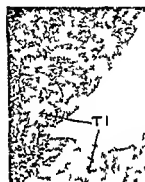


Fig 4

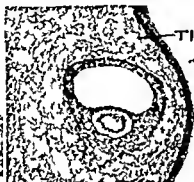


Fig 5



Fig 6



Fig 7



Fig 8



Fig 9

Fig 1 A section of an ovary showing a retrogressing graafian follicle. The stratum granulosum is degenerating and the theca interna layer is proliferating $\times 25$

Fig 2 A stage in the progression of atresia of a graafian follicle somewhat later than that shown in Figure 1. The stratum granulosum is disappearing, the theca interna is well developed, and in one part hyaline change is present $\times 18$

Fig 3 A cystic atretic follicle showing the disappearance of the stratum granulosum in one part with hyalinization of the theca interna layer (H) $\times 13$

Fig 4 Photomicrograph of a portion of the wall of a cystic atretic follicle. The stratum granulosum and the subjacent theca interna (T I) are present $\times 60$

Fig 5 Photomicrograph showing a retrogressing graafian follicle and also portion of the wall of a cystic atretic follicle. Theca interna (T I) $\times 67$

Fig 6 Photomicrograph of a small atretic follicle in which the stratum granulosum has disappeared. Hyaline change has commenced in the theca interna $\times 85$

Fig 7 Photomicrograph of a portion of the wall of another atretic follicle. Hyaline change is advanced further than it is in the specimen which is shown in Figure 6 $\times 120$

Fig 8 Photomicrograph of a portion of the wall of a granulosa luteal cyst. The tissue is partially hyalinized but remnants of both the stratum granulosum (S G) and theca interna (T I) may be seen $\times 17$

Fig 9 Photomicrograph showing a portion of the wall of a small collapsed atretic follicle. The theca interna (T I) is present and hemorrhage (H) has occurred into it at one place. The stratum granulosum is present as a single layer of epithelium $\times 90$

of adequate descriptions in current textbooks and articles

Corpus luteum cysts A number of pathological conditions arise which correspond to the

various stages in the life history of the luteal body. There are (1) corpus luteum cysts (2) corpus albicans cysts (3) corpus luteum blood cysts and (4) corpus luteum tarry cysts



Fig 10



Fig 11



Fig 12



Fig 13

Fig 10 Low power photomicrograph of section of the corpus luteum showing typical luteal tissue in the wall of the cyst. The cyst is lined by a single layer of cuboidal cells.

Fig 11 Low power photomicrograph of section of the corpus luteum showing typical luteal tissue in the wall of the cyst. The cyst is lined by a single layer of cuboidal cells.

Fig 12 Low power photomicrograph of section of the corpus luteum showing typical luteal tissue in the wall of the cyst. The cyst is lined by a single layer of cuboidal cells.

Fig 13 Low power photomicrograph of section of the corpus luteum showing typical luteal tissue in the wall of the cyst. The cyst is lined by a single layer of cuboidal cells.

Cysts of the corpus luteum are characterized by the presence of clear fluid in the cavity of an enlarged luteal body. It possesses typical luteal tissue in the wall and this shows the festooning which is observed in the normal corpus luteum.

The presence of a small amount of fluid is a constant finding in corpora lutea and this may be slightly increased in many cases so that all gradations are found between the

normal body with a little fluid in its central portion and a well formed cyst.

As the luteal body ages the changes mentioned take place and they occur whether it has a very small cavity or is a comparatively large cyst. Thus cysts of the corpus luteum may show many appearances according to the amount of hyaline tissue and stroma tissue present in the wall. The end result when all the luteal tissue has disappeared and hyaline



Fig 14



Fig 15



Fig 16



Fig 17



Fig 18



Fig 19

Fig 14 A higher power view of portion of the wall of the cyst shown in Figure 13. $\times 38$

Fig 15 Photomicrograph showing the typical appearance of a collapsed atretic follicle. The stratum granulosum is still present in part. Compare with the epithelium-lined cyst shown in Figure 16. $\times 15$

Fig 16 Photomicrograph showing an epithelium-lined cyst—which in portion of its wall was typically endometrial—arising from an atretic follicle. The gross similarity to an atretic follicle is shown by comparison with the cyst which is shown in the photomicrograph Figure 15. $\times 15$

Fig 17 Photomicrograph of a portion of the wall of an atretic follicle which is developing an epithelium lining. What relationship this new development bears to the cell of the retrogressing stratum granulosum is at present undetermined and is not of paramount importance from the point of view of the hypotheses given in this paper. $\times 25$

Fig 18 Photomicrograph of portion of the wall of a blood cyst of the ovary. It is lined here by typical luteal cells but in other portions of the cyst the lining is of the endometrial variety. $\times 38$

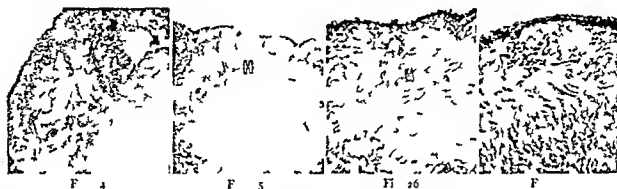
Fig 19 Portion of the wall of a cystic follicle which is developing an epithelial lining. $\times 38$

tissue only is present is the corpus albicans cyst.

2 The characteristics of the corpus albicans cyst will be apparent from the description given of its origin. The cyst contains in its wall hyaline tissue which is developed from corpus luteum tissue. It is usually small and a typical example has an unmistak-

able appearance though when but little hyaline tissue is present (in comparison with the amount of stroma tissue)—as happens in larger cysts—recognition may be more difficult.

Some writers doubt the occurrence of this cyst. Probably the development of cystic changes in a corpus albicans does not take



Fg 1 Photomicrograph of a part of the wall of a old fetal cyst—probably from the fetal wall and the (t) shown by hyaline tissue. $\times 75$

Fg 2 Photomicrograph of a part of the wall of a blood cyst of the ovary showing the epithelium. $\times 75$

Fg 3 Photomicrograph of a part of the wall of a blood cyst of the ovary showing the epithelium. $\times 75$

Fg 4 Photomicrograph of a part of the wall of a blood cyst of the ovary showing the epithelium. $\times 75$

Fg 5 Photomicrograph of a part of the wall of a blood cyst of the ovary showing the epithelium. $\times 75$

Fg 6 Photomicrograph of a part of the wall of a blood cyst of the ovary showing the epithelium. $\times 75$

Fg 26 Photomicrograph of a part of the wall of a blood cyst of the ovary showing the epithelium. $\times 75$

Fg 27 Photomicrograph of a part of the wall of a blood cyst of the ovary showing the epithelium. $\times 75$

Fg 28 Photomicrograph of a part of the wall of a blood cyst of the ovary showing the epithelium. $\times 75$

Fg 29 Photomicrograph of a part of the wall of a blood cyst of the ovary showing the epithelium. $\times 75$

Fg 30 Photomicrograph of a part of the wall of a blood cyst of the ovary showing the epithelium. $\times 75$

Fg 31 Photomicrograph of a part of the wall of a blood cyst of the ovary showing the epithelium. $\times 75$

Fg 32 Photomicrograph of a part of the wall of a blood cyst of the ovary showing the epithelium. $\times 75$



Fig. 31

Fig. 32

Fig. 33



34

Fig. 35

Fig. 36

Fig. 31 Low power view of portion of a blood cyst of the ovary. It was lined by columnar epithelium with a sub-epithelial stroma (see Fig. 32). Its luteal origin is indicated by the presence of hyaline tissue (compare with Fig. 44) and the site of rupture of the antral follicle which gave rise to the original luteal body may be seen at the depression on the surface of the ovary. $\times 10$

Fig. 32 Photomicrograph of portion of the blood cyst shown in Figure 31. The epithelium is columnar in type and crypts cut in section give the appearance of glands. Hyaline tissue which indicates the previous presence of the luteal tissue is shown at H. $\times 75$

Fig. 33 Photomicrograph showing a glandular space near the surface of the ovary. This was not an implantation but arose by continuity from the epithelium lining an old luteal cyst. This was demonstrated by serial sections. Compare with Figure 44. $\times 75$

Fig. 34 Photomicrograph of a portion of an epithelium lined luteal cyst. The hyaline tissue is shown at H. ovarian tissue O. $\times 12$

Fig. 35 A portion of the wall of a luteal cyst. $\times 20$

Fig. 36 Higher power view of portion of the wall of the cyst shown in Figure 35. The epithelium is columnar and a group of pseudoxanthomatous cells are present. $\times 98$

place but that hyalinization occurs in the wall of a luteal cyst no one who has examined these cysts can doubt.

It is of interest that the progress of the change in the wall of a corpus luteum cyst does not proceed uniformly in all parts and

at the same rate thus typical luteal tissue may be found in one portion and hyaline material in another part. Incomplete examination of such a cyst may lead therefore to the diagnosis of either luteal or corpus albicans cyst.



Fig. 37. P. t. f. ep. thel. m. l. n. d. b. l. o. d. c. y. t. f. l. l. c. u. l. n. X 100.

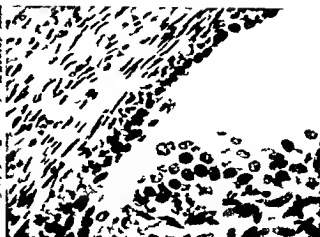


Fig. 38. H. g. h. e. p. o. w. e. w. f. t. h. e. e. p. t. h. l. m. l. n. i. g. t. h. c. y. t. h. n. i. n. F. i. g. e. 37. X 375.

3. **Luteal blood cysts** Since hæmorrhage occurs at the stage of vascularization of the corpus luteum and since cystic change may occur in this structure the occurrence of corpus luteum blood cysts requires little discussion. In a manner similar to that described in all stages from the hæmorrhagic corpus luteum to the corpus luteum blood cysts several centimeters in diameter are revealed by an examination of these structures.

4. **Corpus luteum tarry cysts** The change in the blood occurring in cysts of the ovary from the normal to a tarry or chocolate consistency is a well recognized phenomenon. It is due to a physicochemical change which is merely an indication of the age of the blood. Similar changes are observed in blood in other parts of the body.

The tarry corpus luteum cyst shows the festooning of the wall which characterizes the original body. This is important in the differentiation of the cyst from some to be mentioned subsequently.

All of these cysts are important owing to the occurrence of certain secondary changes.

In a classification proposed by Fraenkel in 1898 luteal cysts of three types were described: (1) those lined by luteal cells; (2) those lined by fibrous tissue; and (3) those in which a heterotopic epithelium lined the cyst on the inner aspect of the connective tissue (Fig. 48).

It is the third group in which we are interested. Any of the various cysts which have

been mentioned previously may show this heterotopic epithelial lining.

It consists of cells of columnar cuboidal or flattened form with a subjacent stroma of round and spindle cells which often support a number of phagocytic cells. Beneath this stroma is the tissue proper of the luteal body—either luteal cells or hyaline tissue.

Crypts may be present in the wall of the cysts and the epithelium lining these may owing to the peculiarities of the direction in which the section has been made show gland-like structures. The epithelium often lines only a portion of the cyst wall.

This epithelium is the key stone on which the conclusions produced in this paper depend.

The atretic follicles The ovary at birth contains about 700,000 ova and during the normal sexual life of the individual only 500 (approximately) of these come to maturity and since the follicles which mature and form corpora lutea are relatively few it is very important and highly instructive to inquire into the fate of the remainder.

At the commencement of the intermenstrual cycle a number of graafian follicles approach maturity. Rupture of one follicle is followed immediately by the retrogression of the others and it has been shown experimentally that this is due to a hormone derived from the developing corpus luteum.

This retrogression of the follicles (atresia) is characterized by the disintegration of the



FIG. 39. Drawing showing the appearance presented by a typical example of the blood cysts as seen at operation

stratum granulosum and a proliferation of the theca interna cells. The typical atretic follicle shows an appearance which is the reverse of that seen in the corpus luteum, i.e. a well marked theca interna layer and a very poorly marked or almost absent stratum granulosum.

The theca interna cells proliferate and swell until they resemble luteal cells. They may accumulate pigment and they are arranged in a radial fashion around the cavity of the follicle.

Changes comparable with those seen in the corpus luteum now occur. Fatty changes take place in the cells and they become replaced by hyaline tissue. Various hyaline bodies result—the corpus atreticum, the corpus candidans and the corpus fibrosum.

It will be seen that since these various structures are many times more numerous than the luteal bodies and their derivatives the follicles, their derivatives and the pathological conditions arising therefrom are highly important in the elucidation of multiple cysts of the ovary.

Cysts arising from the atretic follicle. Dilatation of atretic follicles occurs in any of the stages of their development and several cystic structures may result. In addition hæmorrhage gives certain modifications. Many varieties

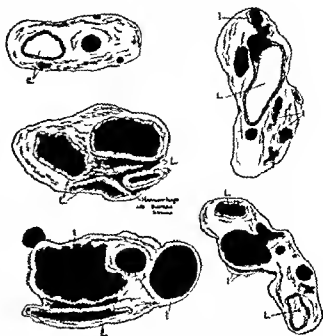


FIG. 40. Drawing of the appearances presented on section of right ovary removed in case shown in Figure 39

may be considered under the following headings: (1) follicular cysts; (2) follicular blood cysts; (3) follicular tarry cysts (tarry luteal cysts).

The follicular cysts are among the commonest structures met with in the ovary. The vast majority are small and are merely minor variants of the normal process of retrogression of the graafian follicle. On the other hand large cysts may develop from the atretic follicle. The largest cyst which the writer was able to demonstrate as being of this origin was 14 centimeters in diameter. All of these



FIG. 41. Photograph of an ovary showing a luteal cyst, a follicular cyst and an endometrial cyst. This last was developed from an atretic follicle.

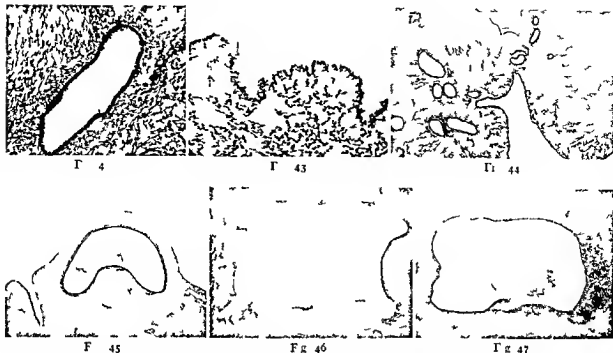


Fig 42 Photomicrograph of a typical gland which might be described as endometrial. Cystic part of the gland is indicated by its position relative to the surrounding tissue. $\times 110$

Fig 43 Photomicrograph of a portion of an endometrial cyst. In Fig 44 the cyst is shown in its position relative to the surrounding tissue. $\times 110$

Fig 44 A composite drawing of an ectopic endometrial cyst. The cyst is shown in its position relative to the surrounding tissue. $\times 110$

Fig 45 Drawing of a follicular cyst. The cyst is shown in its position relative to the surrounding tissue. $\times 110$

Fig 46 Drawing of a corpus fibrosum. The corpus is shown in its position relative to the surrounding tissue. $\times 110$

Fig 47 Drawing of a luteal cyst. The cyst is shown in its position relative to the surrounding tissue. $\times 110$

cysts show a definite theca interna layer of cells with a few cells of the stratum granulosum on the inner aspect. As the cyst ages hyaline changes occur comparable with those seen in the small retrogressing follicle. Thus not only are there corpus candidans cysts but all intermediate stages are to be found. The corpus fibrosum is a variation from the normal hyaline body in which fibrous tissue is formed instead of hyaline material. In some of these cysts there may be fibrous tissue in the whole or in portion of the cyst wall. Usually however it is possible to find hyaline tissue in some or other portion of the wall so that there need be no doubt as to the origin and nature of the structure. Sometimes old hyaline bodies are found in the ovary and it is

hyaline tissue is seen in the stratum granulosum due to implantation.

Fig 46 A drawing made from a section showing blood cyst which is lined by luteal tissue. The blood is seen in the center of the cyst. The lining is composed of luteal cells.

Fig 47 Drawing of a cyst showing luteal tissue in the wall. The cyst is lined by luteal cells. The wall is composed of luteal cells. The cyst is filled with fluid.

not possible to determine their origin and similarly some cysts may defy classification.

This applies particularly to the differentiation of cysts of atretic follicle and corpus luteum origin in their later stages.

Luteal cysts of follicular origin. The usual sequence of events during atresia is a retrogression of the stratum granulosum and a proliferation of the theca interna cells and a luteal change in these cells. In one well known condition however although the follicles are undergoing atresia the stratum granulosum proliferates as well as the theca interna. This is the multiple luteal cyst associated with hydatidiform mole. A great deal of discussion has waged around the origin of these luteal cells. The follicles do not rupture on the surface and the ovum

dies so that the cysts belong to the retrogressive or atretic series and it was thought that the cells arose as usual from the theca interna layer. It has been demonstrated by Strassmann however that they arise from the cells of the stratum granulosum.

There are therefore two varieties of follicular cysts

(1) In which there are a well developed theca interna layer and an extremely poorly marked stratum granulosum layer (2) in which representatives of both layers are well marked

Blood cysts Hemorrhage occurring in the corpus luteum and its derivatives occupies the stratum granulosum and from this ruptures into the central cavity. In the case of the typical atretic follicle hemorrhage takes place in the theca interna cell layer and may rupture into the surrounding tissue. Pressure inward pushes the stratum granulosum before it so that blood does not usually occupy the cavity of the follicle.

Statements are sometimes made that hemorrhage never occurs into the follicular cavity but this is not correct. The writer has frequently observed blood in follicular cysts in hyperemic conditions of the ovary and in the ovaries which contain multiple blood cysts.

As with the corpus luteum blood cysts the cyst wall may show any of the stages of retrogression from the typical luteal cells (theca interna in origin) to typical hyaline or stromal tissue with a complete absence of luteal cells.

Tarry cysts of follicular origin These cysts have been considered in several papers which are referred to in a paper recently submitted by the writer (3). Changes in the blood occurring in the cysts just described are responsible for the character of the fluid in these cysts.

Since there are two main varieties of follicular cysts so two principal forms of tarry luteal cysts of follicular origin may be differentiated (a) the tarry theca luteal cyst (b) the tarry granulosa luteal cyst.

These names were suggested by Shaw to indicate that in one cyst the cells were probably of theca interna origin while in the other cells of the stratum granulosum are also present.

It was pointed out in the paper mentioned that the cells occurring in the walls of these cysts are of atypical luteal character and since they become replaced gradually by a connective tissue all stages may be found between the easily recognizable cyst containing well marked (if atypical) luteal cells and the one in which few luteal cells are to be found.

Secondary changes The importance of the development of a lining of heterotopic epithelium in the case of the corpus luteum cysts has been mentioned. This lining is to be found both in corpus luteum cysts and in the cysts of follicular origin. The epithelium has the same characteristics as in the corpus luteum cysts—may be columnar cuboidal or flattened in shape and there is present a subepithelial stroma.

The cysts possessing this lining are of extreme importance in this discussion so that they will all be considered at this stage in further detail.

EPITHELIUM LINED BLOOD CYSTS OF THE OVARY

A cursory survey of the foregoing descriptions shows that there are a large number of cysts of the ovary which possess columnar or cuboidal epithelium lining. These cysts do not present in reality as formidable an array as might be expected since they are but modifications of the normal elements found in the ovary and do but correspond to these various structures and can be simply classified.

If any one of these cysts be considered apart from its fellows it immediately becomes difficult of analysis and comprehension. It seems to me that many of the difficulties that have arisen in the interpretation of the blood cysts of the ovary are due to such segregation of material from its physiological and morphological context. Hence it is necessary when examining epithelium lined structures in the ovary to determine to which of the bodies of the series already described they are related.

From the description previously given it may be deduced that numerous atypical forms are to be met e.g. owing to the irregular rate of progression of the various processes taking place in the wall but in the vast majority

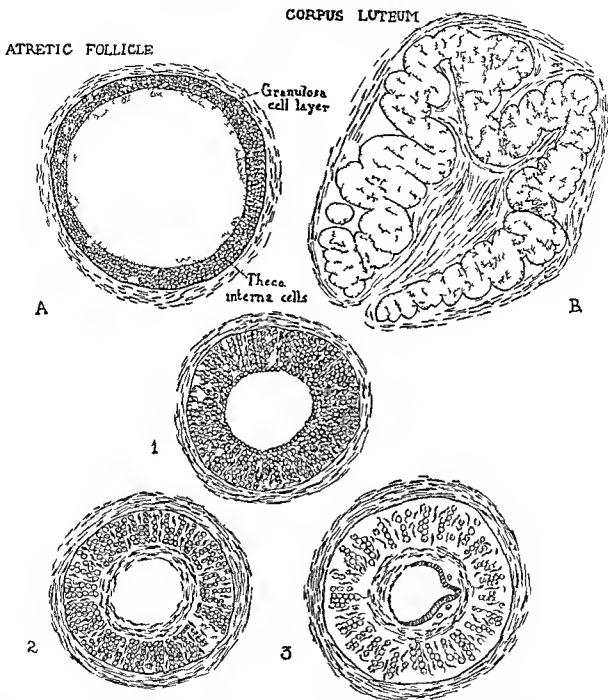


Fig 48. Diagrammatic representation of the various types of follicles and cysts of the corpus luteum. (A) Atretic follicle. (B) Corpus luteum. (1) Follicle with thick wall. (2) Follicle with thin wall. (3) Follicle with thick wall and central cavity.

In some cases some part or other of the wall gives a clue to the nature of the cyst.

In summary the various cysts observed are

A Corpus luteum cysts corpus albicans cysts follicular cysts which may also become hyaline

B Blood cysts of various types

C Tarry cysts (a) corpus luteum cysts (b) tarry theca luteal cysts and (c) tarry granulosa luteal cysts

Many variants of these forms may arise. Any of these cysts may possess an epithelial lining.

A description of some of those which have been investigated by the writer may be of interest.

For the reasons given previously, cysts of the corpus luteum series are comparatively uncommon. One of these is shown in Figures 31 and 44. Strong evidence for the conclusions concerning its origin can be obtained from the examination of even a single section. Thus the depression on the surface of the ovary where the cyst comes closest to this surface is very apparently the site of rupture of the originating graafian follicle. The hyaline tissue is well seen round the wall of the cyst. The differences between typical compact hyaline tissue of a corpus albicans and the semifibrous hyaline tissue observed in the wall of such cysts as this seems to be explicable readily by the difference in the conditions of their formation, position and relationships. The other cysts which were present in this ovary were all of the atretic follicular type.

Some of the cysts of the atretic follicular series are almost perfect specimens. Such a one is shown in Figure 45. This cyst when seen macroscopically seemed to be an excellent example of implantation, but microscopic examination showed that it was a hyalinized atretic follicle which had developed an epithelial lining.

The majority of the cysts as previously stated do not give such a typical appearance. Different stages of retrogression of the luteal cells may be observed in various portions of the cyst wall. Thus in one area luteal cells (atypical but recognizable) will be found in other parts hyaline tissue and in still others no definite evidence whatever of the nature of the cyst is obtainable. Such a cyst is shown diagrammatically in Figure 47. This cyst was so demonstrated by a lucky section and it was such appearances that first suggested to the writer the mode of formation of such cysts as those under consideration. It

was later that the importance of the hyaline tissue—in the absence of luteal cells—was appreciated.

It will be seen that in such a cyst the epithelium does not extend throughout the whole extent of the wall and it is usual for the epithelium to be present only in those parts in which luteal cells are absent. This is of very considerable importance. Should the section happen to be taken in a plane at an angle e.g. right angle to that shown in the figure it will be apparent that one section taken at one end of the cyst may show only the epithelium in the wall and the one taken at the other end of the cyst may show only luteal tissue in the wall. Without serial sections it would be concluded almost certainly that different cysts were being investigated.

That the importance of hyalinized tissue in the wall of these cysts has not been appreciated is apparent from a perusal of many of the reports of endometrial glands and from an examination of accompanying illustrations. Hyaline tissue has been remarked upon as an apparently casual observation by many writers.

It might be mentioned here that phagocytic cells (pseudoxanthomatous) are often present in large numbers in the walls of these cysts and it is important that they should be distinguished from luteal cells. Their morphology, arrangement and relationships to the surrounding tissue render this a matter of relative simplicity.

In some of the cysts, though portion of the wall shows evidence of luteal or hyaline tissue other parts are formed by ovarian stroma directly underlying epithelium without any suggestion that hyaline tissue had ever been present originally (see Fig. 46). No adequate explanation is available though it is possible that the distention of a cyst was too great or too rapid to allow commensurate stretching of the luteal or hyaline portion of the cyst wall so that the cyst contents in some portions have come into contact with the ovarian stroma and subsequently the epithelium has grown over this. However this may be the presence of ovarian tissue in the immediately subepithelial portion of the cyst wall is of common occurrence. No example of

this association of the ovarian tissue with the epithelium throughout the whole wall has yet been observed by the writer. In all cases there was some evidence of the presence of the luteal or follicular material. It is not intended that this statement should suggest that this may not occur but that its occurrence is uncommon and in any apparent example serial sections are essential to determine the accuracy of the observation.

The epithelium The epithelial cells which line these cysts have been described. Their shape varies in different places. There is usually a single layer. Where the cells are columnar the nuclei are basal in position. The cells in some cases resemble the cells of the endometrial lining but more frequently they do not especially when they become cuboidal or flattened. The columnar cells may rest on an apparent basement membrane though some seem to be semisyncytial in form and to be continuous with the subjacent tissue cells.

Although the morphological characters of the tissue of the so called endometrial glands are said to be almost identical with those of endometrium a reference to descriptions and illustrations shows that a great deal of latitude is allowed in interpretation. Thus the cells are just as reminiscent of epithelial cells in other parts of the body and in many cases they do not in any way simulate endometrial epithelium.

The stroma Beneath the epithelium in these cysts there is usually a collection of round or spindle cells packed more or less closely together and this tissue may closely resemble the subepithelial stroma of the uterus.

In many cases however the resemblance is very remote. This does not affect the conclusions which are here given since the license used in the descriptions of the epithelium of the endometrial glands is also exercised in the case of the stroma which is described as being at times scanty or absent.

Where the epithelium lines a surface without irregularities the subepithelial stroma is scanty but it is abundant around crypts and glands.

Epithelium lined glands Crypts in the walls of these tarry cysts are common and

these are lined almost invariably by columnar epithelium even when the surfaces of the main cavity are lined by flattened cells or where even these are absent.

These projections of the central cavity may extend for a considerable distance and owing to a meandering course the plane of section may cut these crypts in one or more places. The appearance of glands thus obtained is not uncommon in the walls of these cysts.

As stated the subepithelial stroma is particularly abundant around these glands so that it is these more particularly which give a close imitation of endometrium.

An important feature which is illustrated in Figure 44 is the projection of these crypts beyond the boundaries of the original cyst wall i.e. beyond the area containing hyaline tissue. Thus it is possible to discover glands in ovarian tissue without any proximate evidence of derivatives of luteal or follicular bodies. Figure 33 shows such a gland space which was shown by serial section to be in continuity with the central cavity of a luteal cyst. In the absence of this evidence such a gland would be regarded as of endometrial that is implantation origin.

The invasive properties of this epithelium here illustrated are extremely important from the point of view of the results of rupture of these cysts with spilling of their contents into the peritoneum. This is discussed later.

The origin of the epithelium No unanimity of opinion has been reached concerning the origin of this epithelium. Three hypotheses have been advanced.

- 1 An origin from the surface epithelium of the ovary
- 2 An origin from the endothelium of vessels lying in the connective tissue lining the wall of the cyst
- 3 An origin from luteal cells or their progenitors

That the epithelium lining the walls of some of the luteal cysts is continuous with and presumably developed from the surface epithelium is easily demonstrated in some examples. The ease with which the surface epithelium grows into any space in the ovary communicating with the surface renders such an explanation reasonable for these cases.

The majority of cysts cannot come into this category however since most of the graafian follicles do not rupture and consequently their cavities do not become continuous with the exterior

Appearances occasionally suggest that the endothelium of the vessels in the connective tissue may proliferate form a lining to the cyst and become columnar. Though endothelium is known to change shape in this fashion the evidence in the case of these cysts is not in any way conclusive. This suggestion is similar in kind to that made by Schiller in which aberrant endometrium arises by metaplasia of lymphatic endothelium.

Fraenkel suggested originally that the cells arise from luteal cells. Although the evidence is inadequate as yet observations made by the writer point in this direction. Certain well known phenomena suggest this origin also. (1) A columnar epithelium may be found in simple atretic follicles. Continuity between these cells and cells of the degenerating stratum granulosum may be observed. (2) The life history of the epithelium (the formation of glands, the effects of rupture of the cysts and the development of tumors) more strongly suggests an epithelial (luteal) than an endothelial origin.

The origin of this epithelium is not of paramount importance in the considerations arising in this paper except that it arises probably by metaplasia from cells which are present in the ovary and not from cells of another organ by a peculiar process of transplantation.

Endometriosis. Let us pause to consider the condition of multiple blood cysts of the ovary from the point of view of the protagonists of the transplantation hypothesis.

The condition found in the ovary consists of numerous blood cysts and blood is found both in the cavities and in their walls. They are lined by an epithelium which in a typical case is columnar but may be cuboidal or flattened (stated to be by the pressure of the cyst contents). Beneath the epithelium there is a stroma of spheroidal cells which resemble the immediately subepithelial tissue in the wall of the uterus. In some circumstances this may be scanty or absent.

Most reports and descriptions recognize some follicles or luteal bodies in the organ but these are regarded as incidental. The presence of hyaline tissue in the wall of some of the cysts has been mentioned.

The difficulties in the acceptance of the implantation hypothesis are several. (1) The absence of epithelium (or the extreme flattening of epithelium) and the absence of stroma which may occur over large areas of the cyst walls renders necessary the further hypothesis—of destruction or distortion of these tissues. Their original presence on those areas in which it is not found is pure assumption. (2) The hypothesis ignores the hyaline tissue which is present in the walls of some of the cysts. (3) It overlooks the associated small cysts of the ovary which are of follicular or luteal origin and therefore overlooks completely the normal processes of the organ involved. (4) It takes no cognizance of the pathological changes in tarry luteal cysts.

Suppose we turn now to the physiological changes which play an important part in the implantation hypothesis. Hemorrhage occurs in these cysts in association with the menstrual period. It is known however that hemorrhage into luteal cysts occurs at these periods also. I have observed at operation bleeding from a tarry luteal cyst (proved by subsequent section) during a menstrual period—both tarry material and fresh blood were present. The occurrence of hemorrhage therefore does not necessarily support an endometrial origin.

The complications which are most important are (1) rupture of the cysts with the formation of secondary growths on the peritoneum and (2) the development of carcinoma in endometrial cysts.

Rupture of these ovarian cysts with the formation of secondary cysts in the peritoneum is accepted by Sampson. He considers that the ovary provides a suitable soil for the early growth of the cysts. Why is it though that endometrial growths do not occur in the peritoneum more frequently without the involvement of the ovary? In this respect it should be noted that sometimes microscopic examination of ovaries which appear to be normal and which are

associated with peritoneal cysts show also the epithelium lined cysts

If we grant that the ovary is the starting place for abdominal blood cysts then both the implantation hypothesis and the tarry cyst suggestion are on common ground because the transperitoneal spread of tissue in the peritoneal cavity after the rupture of a cyst is a well recognized phenomenon

The ability of the glands arising in the tarry cysts to invade tissue is shown by their development beyond the confines of the wall of the original cyst (Figs 32 and 44). That they should develop further when split into the peritoneum is therefore not surprising

As to the development of carcinoma Sampson has postulated for some of the carcinomata of the ovary an origin from the epithelium lining the endometrial cysts. These tumors may arise just as readily from the epithelium lining tarry cysts. Shaw and the writer have described such cases (2).

The resemblance between typical endometriosis and the epithelium lined tarry cysts was discussed previously by the writer (3). At this time there were one or two examples concerning which the evidence for the follicular origin was inadequate and an open mind was kept concerning them. Still the inference that both conditions were in reality the same seemed very strong. Subsequently the evidence in these cases has been forthcoming.

This study was commenced and indeed carried to its present conclusion from considerations of the ovarian cysts. Observations of other apparently related cysts have been made however and from the point of view of this study appear to fall into five groups: (1) ovarian cysts (2) peritoneal cysts (3) incisional cysts (4) uterine cysts (adenomyomata) and (5) certain miscellaneous cysts e.g. umbilical.

Ovarian cysts are here discussed and whichever hypothesis is adopted such cysts appear to be the origin of many other cysts.

The peritoneal cysts are produced in almost every case by the implantation of epithelium in the peritoneum (a different proposition from the regurgitation of pieces of tissue of dubious viability through the

fallopian tubes) from tarry cysts. Even the vaginal cysts may be explained by the burrowing of the glands through the vaginal vault from the pouch of Douglas which is an early site for the implantations after the rupture of cysts. The burrowing propensities of the glands in the tarry cysts has been noted. These peritoneal cysts depend on the cysts of the ovary and do not present any serious difficulty to the acceptance of the hypothesis of the luteal origin of the tarry cysts. It should be noted however that the serosal hypothesis must be seriously considered and may prove to be the explanation of some of the peritoneal examples (see endometrial cysts of umbilicus).

The cysts occurring in incisions require little mention since they may be called to assist any hypothesis. Other covering tissues e.g. skin may produce cysts after their implantation. This result might be expected from some of the experimental work on implantation of tissue.

The adenomyomata of the uterus and rectovaginal septum for the present fall into a separate category.

The endometrial cysts of the umbilicus present a difficult problem whichever view of causation is favored. The writer is disposed at present to accept the serosal suggestion of the development of these structures. It is possible to correlate this with the tarry luteal cyst idea but any complication of the discussion is to be deprecated at this stage.

SYMPTOMATOLOGY

Only one symptom requires special mention and that is sterility. It is the most constant symptom and often it is the one which brings the patient for treatment.

The explanation given usually is that some mechanical factor such as the adhesions which are almost invariably present or some intra-uterine obstruction which may have caused the reverse flow of menstrual fluid through the tubes e.g. a fibromyoma or other factor prevents the passage of the ovum into the uterus. It is well known however that extraordinary obstructions may be surmounted by the ovum in other conditions so that some further explanation seems necessary.

The examination of the ovaries which are the site of multiple tarry blood cysts shows a number of atretic follicles and their derivatives and an occasional corpus luteum derivative but actual corpora lutea are rare. Those which are present are atypical and aged. Here then is an explanation of this interesting symptom: the graafian follicles have not ruptured onto the surface of the ovary with the subsequent formation of a corpus luteum but have instead, undergone retrogression. This introduces the problem of etiology.

ETIOLOGY

The causation of the luteal cysts and especially the tarry cysts is shrouded in mystery.

A number of observations are available but a physiological correlation is not possible at present.

The retrogression of the maturing graafian follicles which follows the rupture of one follicle and the formation of a corpus luteum suggests the action of a hormone.

The demonstration by Aschheim that hormone from the pituitary gland plays a part in the causation of the multiple luteal cysts associated with hydatidiform mole shows that not only the genitalia but other ductless glands must be considered.

As stated here is but a ray of light. It remains for future research to dispel the obscurity of this subject.

SUMMARY

1. Where speculative variations of several pathological principles are required to explain a pathological phenomenon the explanation advanced is probably wrong and suggests the necessity of reviewing the observations on which it is based. It will be found that well established pathological principles

suffice when the observations are sufficiently complete and carefully analyzed.

2. The implantation suggestion concerning 'endometriosis' of the ovary requires for its foundation hypothetical phenomena which have but doubtful counterparts in other portions of the body.

3. Pathological principles governing the interpretation of phenomena are distorted thereby.

4. An application of these principles to the multiple blood cysts leads to different conclusions further observations and an alternative hypothesis.

5. A resumé of the life history of the ovarian structures is given and an explanation of the blood cysts in terms of these structures is proposed.

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MUSCULAR RELAXATION PRODUCED BY NOVOCAIN AS AN AID IN TENDON REPAIR¹

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THE present study was stimulated by the difficulties encountered in attempts at tendon suture. Our clinical experience led us to believe that retraction of the proximal end of the cut tendon was one of the most formidable obstacles to immediate suture and subsequent repair. We likewise felt that the development of a method which would either diminish or abolish this retraction would serve to decrease the number of failures in tendon suture. It seemed evident that relief of tension on the suture line would favor union, permit of the use of less suture material and lessen the likelihood of the tearing out of the sutures used in repair.

Recently Moser suggested a method of overcoming the retraction of the muscle tendon. He produced muscular relaxation by the intramuscular injection of tutocain through a transverse incision over the belly of the muscle involved. He termed this method transverse incision anaesthesia and regarded it as an important part of tendon suture. No mention was made of the extent and duration of the relaxation of the muscle nor was there offered any explanation of the mechanism by which this relaxation was produced.

It was our impression that the suggestion of Moser should be studied in greater detail with a view of more clearly establishing its clinical value.

The extent to which tendons do retract was brought out by Bonikowsky. He made observations on patients who sustained severances of the flexor tendons of the forearm and was impressed with the relationship existing between the extent of retraction and the total length of the muscle tendon proper. He found when a tendon was severed that the proximal end retracted and that the distance between the two cut ends represented in most instances one seventh of the total length of the muscle tendon as measured from the point of origin to its insertion. He made use of these observations in subsequent cases by

making a transverse incision over the calcuated site of the end of the retracted tendon. Through this incision he could thread the proximal end through its sheath to the site of the original wound and thus effect tendon suture. This technique eliminated the danger of contaminating the tendon sheath by manipulations from below designed to locate the retracted tendon.

In 1882 Maclellan described a similar procedure except that the distance of the transverse incision from the site of injury was left to the judgment of the surgeon and the stump was not always found at the selected level.

Certain phenomena have already been definitely established as occurring in muscles subsequent to the severance of their tendons. There also exists a rather comprehensive knowledge of the effects of the injection of local anaesthetics into skeletal muscle.

When a tendon is severed anywhere along its course the proximal end retracts leaving a gap between the cut surfaces. The separation of the cut ends is due to a contracture of the muscle. The initial phase of contracture is termed primary hypertonic contracture. It is brought about by a continuous stream of nerve impulses reaching the muscle from the central nervous system. If approximation of these cut surfaces of a tendon is not made at once the gap between them increases until it reaches a fixed distance, the muscle passing into a secondary state of contracture to which the name myostatic contracture is given. Myostatic contracture is defined by Ranson as the fixation or setting of an immobilized muscle in a new and shorter than normal resting length. This condition does not take place in the whole muscle at once but develops gradually probably by different muscle fibrils becoming involved consecutively. It is the summation of these individual changes which finally determines the extent of the shortening. The terminal state of muscle change passing through primary hypertonic

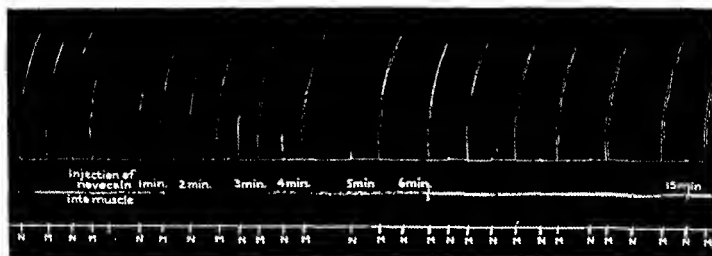


Fig. 1 Alternate stimulation of muscle and nerve showing gradually decreasing response of muscle to nerve stimulation following injection of 1 cubic centimeter novocain (1 per cent) into muscle belly. Direct stimulation of muscle unaltered.

contracture then secondary myostatic contracture is muscle atrophy. Functionally a muscle in myostatic contracture cannot shorten as much as a normal muscle although the rate of relaxation is unaffected. The extensibility of the muscle is likewise decreased but this decrease is due to a loss of ductility; the elasticity remaining normal.

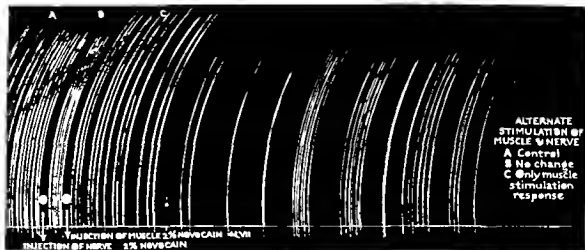
In the preceding discussion we have assumed that the nerve-muscle mechanism is intact. If the nerve supply to the muscle tendon is removed at the time of tenotomy, the normal sequence of primary hypertonic contracture and secondary myostatic contracture with eventual atrophy does not follow. Ranson and Dixon found that 15 days after section of the tendo achillis the gastrocnemius of the white rat had not only undergone shortening but it had also become set at a new length and was less extensible than normal (myostatic contracture). That it was due to a change in the muscle was made apparent when it was demonstrated that it persisted after section of the sciatic nerve. They further showed that if the sciatic nerve were cut at the time the tendon was severed the changes in the muscle did not occur. This makes clear the dependence of the development of the myostatic contracture on the existence of the initial hypertonic contracture. It has also been shown by Froelich and Meyer that immobilization of a denervated muscle does not cause it to alter its extensibility or to become fixed. From the foregoing it may

be concluded that the development of myostatic contracture is dependent upon an uninterrupted nerve-muscle mechanism.

In view of the nature of the secondary or myostatic contracture it is apparent that once this condition has developed tendon suture would be difficult to accomplish without undue tension. It is also clear from the above that any method which would remove the influence of the nervous system from the muscle following tenotomy would prevent this secondary contracture and thereby make it possible to approximate cut ends of a tendon with much less tension.

Severance of the nerve to the muscle would of course accomplish this but the length of time required for regeneration of the nerve would render this method impractical aside from the difficulty of isolating individual muscle nerves.

Experiments dealing with the obliteration of contracture of muscles were carried out many years ago in cases of tetanus. In this condition the continuous shortening of striated muscle (so called rigidity) is caused by the action of tetanus toxin on the spinal cord. The toxin does not have any action either acute or chronic on the muscle or any other contractile element. In 1894 Goldscheider brought about slight relaxation of the contracture in acute tetanus with cocaine and Autokratow secured a brief relaxation of local contracture by the local application of cocaine. Meyer and Weiler succeeded in bringing about



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I j e c t u o f m s c l l i m t e s e p o f m c l t n e r v t m u l t

a prompt relaxation of trismus by the injection of 10 to 15 cubic centimeters of 1 per cent novocain into the bellies of the masseters. From their work it is apparent that relaxation does occur in a muscle in primary contracture by the intramuscular injection of novocain. Froelich and Meyer verified this and in their experiments it was also shown that secondary rigidity that is myostatic contracture produced in rabbits and cats was not affected by the intramuscular injection of novocain.

Liljestrand and Magnus made further studies of the effects of novocain on normal skeletal muscle. They found that in decerebrate cats rigidity of the triceps was greatly decreased by the intramuscular injection of small doses (1 to 1 cubic centimeter of 1 per cent solution) of novocain and completely abolished by the intramuscular injection of larger doses (4 to 9 cubic centimeters of 1 per cent solution).

With the use of small doses active motility remained unchanged and on indirect faradic stimulation from the plexus its threshold value was the same as in the non injected muscle. Larger doses overcame the indirect stimulability of the muscle and therefore the last remnants of decerebrate rigidity and active motility. Direct faradic stimulability of the muscle was still preserved.

When the posterior roots to a foreleg were cut and rigidity brought about after that by

decerebration in which the desensitized leg was involved the intramuscular injection of small doses of novocain had no effect on the rigidity. It required larger doses of novocain which impaired the indirect stimulability of the muscle to decrease and overcome this rigidity. Thus they show that novocain in small doses injected intramuscularly paralyzes the proprioceptive sensory muscle nerves and thereby decreases the reflex decerebrate rigidity. Novocain in larger doses paralyzes the motor nerve ends in the muscle and in that way completely overcomes the rigidity as well as the reflex and indirect stimulability. The response of the muscle to direct stimulation is preserved.

Walsh made similar observations in man in a study of the tremor and rigidity in patients suffering from paralysis agitans. He found that small doses of novocain injected intramuscularly diminished and finally abolished the rigidity of the muscle injected but did not remove the indirect influence through the labyrinthine reflexes. While voluntary control of the muscle was present there developed a sensation of loss of orientation in the extremity. Walsh attributed this reaction to the removal of afferent impulses from the muscle—the proprioceptive impulses. When large doses of novocain were injected into similarly affected muscles there developed a flaccidity of the muscles injected with complete loss of motor control.

TABLE I—DURATION OF ACTION OF NOVOCAIN ON REPEATED DAILY INJECTIONS IN THE SAME MUSCLE GROUP

| N | P C at N ve | | | | P r C t N oc n |
|------|---------------------|---------------------|---------------------|---------------------|-------------------|
| | 1 st day | 2 nd day | 3 rd day | 4 th day | |
| I | 2 | 2.5 | 1.5 | 1 | 2.5 |
| II | 1.5 | 3 | 2.5 | | |
| III | 2 | 1.5 | 2 | 2 | 2.5 |
| IV | 3.5 | 2.5 | 2 | 1 | 2 |
| V | 2.5 | 3 | 2.5 | 3 | 3 |
| VI | 5 | 3 | 1.5 | | |
| VII | 2 | 3.5 | 1.5 | 1 | 2.5 |
| VIII | 3 | 2.5 | 2.5 | | |
| IX | 4 | 3.5 | 2 | 1 | 2.5 |
| X | 2.25 | 3 | 2.5 | 2.5 | 2.5 |

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m y f l g h t n

TABLE II—1 PER CENT NOVOCAIN AND ADRENALIN 1:60,000

| N | 1 st day | 2 nd day | 3 rd day | 4 th day |
|-----|---------------------|---------------------|---------------------|---------------------|
| I | 3 | 2.5 | 2.5 | 0.5 |
| II | 2.5 | 2 | 2 | |
| III | 1.5 | 2.5 | 1.5 | 1.5 |
| IV | 0.5 | 1.5 | 2 | 1.5 |
| V | 2.5 | 2 | 1.5 | 2 |
| VI | 2.5 | 3 | 2.5 | 1 |

d dr al d d t t n oc th p po t f d p t dr m
d r t ppe t p l g h d t n t f oc

We have demonstrated the action of novocain injected intramuscularly with a muscle nerve preparation from the frog. Referring to Figure 1, alternate stimulation of the muscle directly and the nerve to the muscle results in a prompt and vigorous muscle response. Flooding the muscle belly with a 1 per cent novocain solution results in a gradually failing response of the muscle to nerve stimulation. Complete failure of response develops in about 5 minutes. Direct stimulability of the muscle was not interfered with. Injection of the nerve or bathing the nerve in a novocain solution did not diminish the response of the muscle to faradic stimulation of the nerve proximal to the injected area (Fig. 2).



Fig. 3. A Healed severed tendon. Muscle not injected. Note relative amount of fibrous tissue necessary to fill gap. B Healed severed tendon. Muscle injected with novocain (1 per cent) daily for 4 days showing diminished amount of fibrous tissue necessary to fill the gap. Muscles A and B are corresponding muscles of the same animal.

We may therefore conclude that novocain prevents the reception of nerve stimuli by the muscle but does not interfere with the power of contraction. The drug evidently acts on the motor nerve end plates in the muscle preventing the impulses from activating the muscle fibril at its point of contact with the motor nerve. Fulton from his studies concluded that this point of contact or receptive substance resides within the muscle nuclei.

In the living non-anesthetized dog this action of novocain on the muscle can be demonstrated by injecting 8 to 10 cubic centimeters of a 1 per cent solution of novocain into the bellies of the extensor muscles of the paw and toes. As a control a similar volume of normal salt solution may be injected into the corresponding muscles of the opposite foreleg. Such an animal will in the course of 5 to 10 minutes lose voluntary control of the paw. The extensor muscles of which were injected with novocain. On attempting to walk, if the paw strikes the ground perpendicularly the animal's foreleg will fold under with the dorsum of the paw resting on the ground. The opposite foreleg injected with normal saline will not show a similar response. This action of novocain will last for a variable time from 30 minutes to 4 hours. In some animals a 2 per cent solution is more effective than a 1 per cent solution (Table I).

In a limited number of experiments it was found that the addition of adrenalin to the novocain solution did not markedly influence the duration of paralysis but this point is still uncertain since the duration of action varies so much that it is difficult to establish

TABLE III —EFFECT OF REPEATED INJECTIONS

| N | D _d ys | S _d l m d | d _j t d | Amt _{sol} f m | D _j t d | N _h d y |
|-------|-------------------|-------------------------|--------------------|------------------------|--------------------|-----------------------|
| I | 39 | | 4 | 8 | | 0 |
| II | | | 9 | 6 | 1 | 1 |
| III | 4 | 8 | 8 | | 1 | |
| IV | 34 | 1 6 | 1 4 | 8 | 2 | |
| V | 48 | 4 | 9 | 6 | 4 | |
| VI | 48 | 5 | 8 | 5 | 4 | 1 |
| VII | 38 | 4 | 7 | 6 | 4 | 1 |
| VIII | 60 | 6 | | 8 | 5 | 1 |
| IX | 57 | 0 | 5 | 8 | 5 | |
| X | 7 | 7 | 1 | 6 | 4 | |
| XI | 4 | 8 | 1 4 | 8 | 4 | |
| XII | 36 | 6 | 1 3 | 8 | 4 | |
| XIII | 4 | 6 | 5 | 6 | 4 | |
| XIV | 36 | 8 | 1 6 | 8 | 4 | |
| XV | 46 | 7 | 1 3 | 8 | 5 | |
| XVI | 3 | 3 | 9 | 5 | 5 | 2 |
| XVII | 36 | 3 | 7 | 6 | 5 | 2 |
| XVIII | 4 | | 5 | 8 | 5 | |
| XIX | 39 | 8 | | 8 | 4 | |
| XX | | | 2 | 8 | | |

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a basis for comparison (Table II). The reason for this variability of the action lies perhaps in the intact blood supply to the muscle.

In another series of dogs we directed our attention to the effects produced by repeated injections of novocain into the belly of a muscle the tendon of which had been severed. It was found that repeated injections of novocain for 4 to 5 days definitely reduced the amount of retraction as shown in Table III. In our experimental animals this diminution in the extent of the retraction lessened the amount of fibrous tissue necessary to fill the gap produced in the tendons hence healing took place correspondingly sooner (Fig 3).

Microscopic examination of the muscle tissue after repeated injections of novocain reveals no appreciable change from the normal

DEDUCTIONS

It would seem from our experimental work that the injection of novocain into the muscle belly definitely lessens the retraction of a severed tendon. Since the voluntary activities of an unanesthetized experimental animal cannot be controlled the data obtained can not well be applied to man in whom it would be an easy matter to maintain voluntary inactivity. The duration of relaxation following injection may be largely dependent upon the volume of blood flow through the muscle belly per unit of time. Muscle activity produces enormous changes in the circulation through muscles. Krough states that during activity the total capacity of the vascular bed of a muscle may be increased from 0.02 per cent to 15 per cent of the total volume of the muscle. Thus it may be explained how inactivity of an extremity might prolong the duration of the action of novocain while muscular activity would probably shorten the action. In each case it will always be difficult to judge the time necessary to establish union of sufficient strength to permit the discontinuance of efforts at muscular relaxation. We feel that the clearing up of these points will greatly facilitate the clinical application of the suggested use of novocain in tendon repair.

CONCLUSIONS

From the present study we are able to conclude the following:

1. Novocain injected intramuscularly definitely removes the influence of the nervous system on the muscle injected.

2. In the unanesthetized dog the duration of this elimination of nerve influence following a single injection lasts a variable period of time from 30 minutes to 4 hours.

3. Repeated injections with novocain of a muscle the tendon of which has been severed is sufficient to induce continuous muscular relaxation by eliminating the primary hypertonic contracture.

4. The decrease of tendon retraction permits an earlier healing by decreasing the amount of fibrous tissue which is necessary to fill in the gap which is produced in the severed tendon.

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THE EFFECT OF LIGATING THE TAIL OF THE PANCREAS IN JUVENILE DIABETES¹

G DETAKATS M D M S F A C S CHICAGO

IN previous animal experiments carried out following the original suggestion of Mansfield it was found that when the tail of the pancreas was tied off or completely isolated in the dog a series of important changes resulted. The isolated tail ceased to function as an organ of external secretion as the acini degenerated and a marked sclerosis and atrophy of the tail took place (5). The islands seemed to survive this sclerotic process and even showed hyperplasia and hypertrophy. Moreover this hyperregeneration was encountered in the unligated head and body of the pancreas (7). My co workers and I could also demonstrate an increase in carbohydrate utilization in the normal dog following a ligation of the tail of the pancreas (9). The increase in sugar tolerance was noticeable between the third and fourth months after the operation but did not persist to any extent over a period of a year. Causes for the return of the sugar tolerance to normal in the normal dog are now being investigated.

Whether such suggestive experimental findings could be applied in human diabetes was doubtful. In a preliminary report on the first diabetic child operated on Wilder and I pointed out (8) that hypertrophy of the islets might not take place in human diabetes and even if it did the new islets might succumb to the same deleterious influence that inhibited the efficient function of the original cells. Yet the following clinical facts seemed to make a clinical

trial promising. First the great regenerative power of the human islet cells is seen following destruction of pancreatic tissue in acute pancreas necrosis or carcinoma of the pancreas. While temporary glycosuria may occur in these diseases the loss of tissue is readily compensated for and true diabetes mellitus does not frequently result. Such examples from the literature and our own observations have been recorded elsewhere (6). Second the pancreas of the diabetic also shows signs of regeneration. Particularly Weichselbaum and Cecil (3) pointed out the occurrence of hypertrophic islets in diabetes. Other observations are cited in a previous article (6) and an excellent summary together with a number of new observations on islet regeneration is given by Shields Warren.

As we had experimental evidence which suggested a possible increase in islet function and as numerous postmortem observations are on record regarding the regenerative power of the diabetic pancreas we felt that it was worth while to try to determine the effect of ligation of the tail of the pancreas in patients suffering with diabetes.

INDICATIONS

Juvenile diabetes seemed theoretically the type of diabetes in which an attempt to increase sugar tolerance would be most promising. The regenerative power of the islets in children is obviously greater than in adults.

TABLE III --EFFECT OF REPEATED INJECTIONS

| N | D ₁ d y | Sd ₁ t d m | Sd ₂ t d m | Amt sol t m | N y d | N h d y |
|-------|--------------------|-----------------------|-----------------------|-------------|-------|---------|
| I | 39 | | 4 | 8 | | 0 |
| II | 21 | | 9 | 6 | | 1 |
| III | 41 | 8 | 8 | 10 | | 1 |
| IV | 34 | 6 | 14 | 8 | | 1 |
| V | 48 | 4 | 9 | 6 | 4 | |
| VI | 48 | 5 | 8 | 5 | 4 | |
| VII | 38 | 4 | 7 | 6 | 4 | |
| VIII | 60 | 6 | 0 | 8 | 5 | |
| IX | 57 | 10 | 5 | 8 | 5 | |
| X | 7 | 7 | | 6 | 4 | |
| XI | 4 | 8 | 4 | 8 | 4 | |
| XII | 36 | 6 | 3 | 8 | 4 | |
| XIII | 4 | 6 | 5 | 6 | 4 | |
| XIV | 36 | 8 | 6 | 8 | 4 | |
| XV | 46 | 7 | 3 | 8 | 5 | |
| XVI | 3 | 3 | 9 | 5 | 5 | |
| XVII | 36 | 3 | 7 | 6 | 5 | |
| XVIII | 14 | | 5 | 8 | 5 | 2 |
| XIX | 39 | 8 | 12 | 8 | 4 | 2 |
| XX | | 2 | | 8 | | |

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a basis for comparison (Table II). The reason for this variability of the action lies perhaps in the intact blood supply to the muscle.

In another series of dogs we directed our attention to the effects produced by repeated injections of novocain into the belly of a muscle the tendon of which had been severed. It was found that repeated injections of novocain for 4 to 5 days definitely reduced the amount of retraction as shown in Table III. In our experimental animals this diminution in the extent of the retraction lessened the amount of fibrous tissue necessary to fill the gap produced in the tendons hence healing took place correspondingly sooner (Fig 3).

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3. Repeated injections with novocain of a muscle the tendon of which has been severed is sufficient to induce continuous muscular relaxation by eliminating the primary hyper-tonic contracture.

4. The decrease of tendon retraction permits an earlier healing by decreasing the amount of fibrous tissue which is necessary to fill in the gap which is produced in the severed tendon.

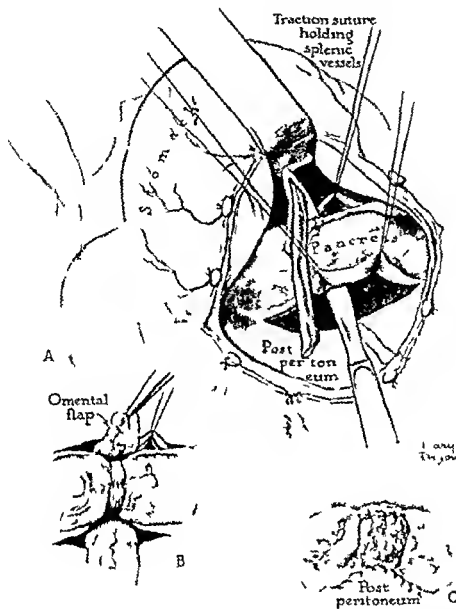


FIG. 2. A wide flexible retractor lifts and everts the stomach. The posterior peritoneum is incised parallel and slightly below the lower margin of the pancreas. The splenic vessels have been dissected off the posterior surface of the gland and retracted by gentle traction. A strip of fascia lata is threaded into the eye of a flexible director which is passed behind the gland. B The strip of fascia lata has been snugly fastened around the pancreas with interrupted and interlocking sutures of fine black silk. A flap of omentum is used to protect the fascial ligature. C The lower lip of the posterior peritoneum is brought up to cover all raw surfaces and close the retroperitoneal space.

of orange juice is given at least 2 hours before operation. Half an hour before the operation a small dose of pantopon ($\frac{1}{3}$ grain to $\frac{1}{4}$ grain) and atropine $\frac{1}{10}$ grain are injected under the skin.

ANÆSTHESIA

While I use spinal anæsthesia as much as possible in diabetics the field of operation lies

so high and the traction on the vagal fibers produces so much nausea that its use has not been considered. Avertin seemed to be equally unsuitable because of the marked acidosis that it produced. Under a light nitrous oxide anæsthesia a typical abdominal field block is produced with 80 to 100 cubic centimeters of a $\frac{1}{2}$ per cent novocain. Three drops of a 1:1000 epinephrine solution are added to

numerically express the increase in tolerance that infections or injuries will influence this gain in tolerance was very obvious in both cases

RESULTS

CASE 1 Detailed history of this case was given in a previous communication (8). The diabetes had been present previous to operation for 8 years. A patient had been under dietary and later insulin management supervised by Dr. Russell M. Wilder at the Mayo Clinic for 6 years. At first his tolerance grew worse steadily. For the last years before operation the patient had been taking 40 units of insulin, the dextrose value of the diet being 10 (carbohydrates 76 protein 50 fat 150).

The operation was performed on January 1, 1929. The small definitely hypoplastic tail was divided with a high frequency cautery. The patient had a stormy convalescence during which time drainage of the omental bursa had to be instituted twice. He was discharged from the hospital on March 16, 1929 on the original diet with 45 units of insulin, 5 units more than before the operation. For the next 3 months the insulin requirement remained steadily between 40 and 38 units. From April 26 on insulin reactions began to occur after the morning dose which prompted a gradual reduction. On May 9, 1929, 110 days after the operation the lowest level of 25 units was reached. From then on the insulin had to be increased to 35 to 39 units, a stitch abscess of the abdominal incision having developed. On June 4 the boy's diet was increased as he still weighed 8 pounds less than before the operation. The new diet consisted of carbohydrates 102 grams, protein 75 grams and fat 161 grams, a dextrose value of 166. On June 18, 1929, the insulin dose was 39 units on August 2, 29 units. On May 31, 1930, 17 months after the operation the patient weighed 5 pounds more than before the operation, had grown an inch and a half, took 63 grams more dextrose with 8 units less of insulin (Chart 1). In September 1930, 20 months after the operation the patient was on a diet of carbohydrates 134, protein 88, fat 162, dextrose value of 200 and 37 units of insulin, a gain of 80 grams of tolerance since the operation.¹

¹ *Severe diabetic child whose previous diabetic history is well known and who was stabilized for 2 years before operation, is at the present writing growing and gaining weight normally with a slightly diminished dose of insulin but utilizing 80 grams of additional dextrose. This definite increase in tolerance occurred in a patient who for 6 years had gradually lost tolerance and who for the last 2 years previous to operation had not shown any change at all.*

CASE 2 Detailed history was given elsewhere (6). He had been in a tuberculosis sanitarium with tuberculous cervical lymph glands for over 3 years, being discharged as well at the age of 10. At the age of 14, 2 years previous to operation, it was first noticed by

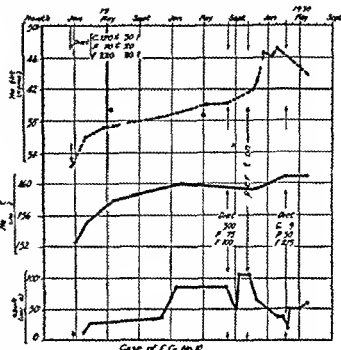
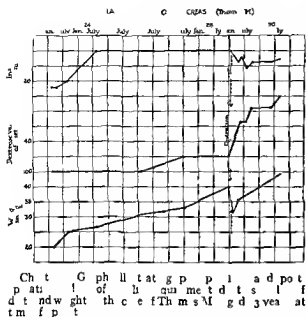


Chart 2. Graph illustrating pre-operative and post-operative values of weight, height, diet and insulin requirement in the case of Eugene G. aged 16 years at time of operation.

the parents that he passed a great deal of urine and had lost weight. He was admitted a few days later to the Billings Hospital in coma. In November 1927 he was discharged on a diet of carbohydrates 90, protein 65, fat 216, 2,600 calories without insulin. Between this date and the date of operation, October 15, 1929, he had 9 further admissions to the Billings Hospital. More and more insulin had to be given but control was very difficult. He had several respiratory infections, an emergency appendectomy, all of which affected his tolerance. He had also been very careless about his diet and ignored it several times. Finally on his tenth admission as he had done poorly on a low carbohydrate, high fat diet and continued to pass sugar on a diet of carbohydrates 220, proteins 85, fats 200, with 80 units of insulin, it was considered advisable to try him on a high carbohydrate, low fat intake. This resulted at least temporarily in a marked decrease in the insulin requirement. On his discharge August 30, 1929, his diet consisted of carbohydrates 300, protein 75, fat 100, dextrose value of 354, with 45 units of insulin.

On October 1, 1929, the patient was admitted to the Wesley Memorial Hospital under the diabetic management of Dr. William H. Holmes (Case No. 147, 279 W. M. H.). He was operated upon on October 18, 1929, during the Clinical Congress of the American College of Surgeons. The pre-operative diet was carbohydrates 300, protein 75, fat 100, and insulin 35, 35, 35. The operation was performed as described in this paper. The patient made an uneventful recovery with primary union of the incision. He left the hospital on the fourteenth day. A month later on the same diet and 60 units of insulin he

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cubic centimeters of Ringer's solution will maintain the mineral balance. It may be difficult to keep up this method of administration for 3 days and therefore the intravenous route is resorted to. In the intravenous route 10 per cent solutions are used with the Henderson needle (10) the normal rate of utilization namely one gram per kilogram per hour never being exceeded. It should take an hour to inject 50 grams of dextrose in a child weighing 50 kilograms. No dextrose is given rectally because probably very little is absorbed and it causes increased colonic distention.

While these children are not totally diabetic they may be considered as such following the insult of the operation. The 100 grams of dextrose must be covered at least by 45 units of insulin equally distributed every 3 hours. However the insulin requirement of diabetics following operation very often exceeds the theoretical requirements. In older diabetics in whom amputation has been done for gangrene in spite of the absence of general anesthesia and infection the amount of insulin required to keep them sugar free may be very high for the first days. If the patient is able to void on the first day the urine is examined every 4 hours and insulin is given according to the diagram outlined by McKittrick and Poot. If specimens of urine are not available microscopic blood sugar deter-

minations are made three times a day. These are specially valuable in helping to determine the overdosage of insulin which must usually be reduced a few days after operation. It is very important to avoid excessive high blood sugars after the operation as a proper control will insure undisturbed wound healing. A 10 cubic centimeter syringe and a 20 cubic centimeter ampule of 50 per cent dextrose are kept ready to use in case of insulin reactions.

Following the first and not later than 3 days a fluid diet consisting of orange juice and milk is started the carbohydrate intake of 100 grams being maintained. A low enema is given with 1 ounce of glycerin to 3 ounces of water on the third postoperative day. If a bowel movement has taken place and the abdomen is not distended gradually a soft diabetic diet and then a full diet is given. At the end of the first week the patient should be back on the pre operative diet. The insulin requirement has been somewhat higher in both cases probably owing to the edema of the pancreas at that time.

The patient is made to sit up the evening of the operation encouraged to take a deep breath at frequent intervals and if no complications set in may be in a wheelchair on the fifth day. Stitches are removed on the tenth day. If primary union took place there is no need to keep the patient in the hospital more than 14 days.

Obviously the postoperative diabetic management must be in the same expert hands as before the operation. It is particularly important to have the diabetes fully controlled after the operation as the presumable hypertrophy and hyperplasia of the islet cells could be easily frustrated in the poorly controlled case. It is best to have the children test their own urine three times a day and to give themselves a little more or less insulin according to the daily requirement. In both of our cases operated upon insulin reactions began to occur about the fourth month following the operation. This calls for a gradual reduction of insulin. If the patients have been made to maintain throughout the entire period their original pre operative diet (a requirement which for certain reasons our cases did not entirely fulfill) the reduction of insulin will

SUMMARY

In two carefully selected cases of juvenile diabetes the tail of the pancreas has been isolated on the basis of animal experiments which show hypertrophy and hyperplasia of the islets and increased carbohydrate tolerance after such an operation. Longer period of observation and further trial on other cases promise a better evaluation of such attempts.

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weighed 42 kilograms (+3 kilograms since the operation). Ten months after the operation the patient had gained another 4 kilograms. Four months after the operation he was getting severe insulin reactions so that the dosage had to be reduced to 40 units a day. On February 25, 1930, he was readmitted to Billing Hospital because of an upper respiratory infection. Temperature rose to 101 degrees F. He required now 70 units of insulin but could soon be reduced to 45-50 units.

On March 9, 1931, he was taken off the high carbohydrate diet and given carbohydrate 50, protein 50, fat 215, a glucose value of 120. The insulin requirement fell to 3 units. The next week the insulin had to be raised and on March 23 a chickenpox developed with high temperature and extensive eruption. The insulin requirement rose to 50 units and his tolerance was upset for several months. On June 20, 1930, Miss Florence Smith, chief dietitian of the Billings Hospital, reported the following data: Diet carbohydrate 39, protein 75, fat 200, a dextrose value of 203 with 55 units of insulin. This was 3 months after the chickenpox infection started but the tolerance seemed to increase slowly (Chart 2).

On October 15, 1930, a year after the operation, the patient was still taking the same diet and insulin although occasionally when under rigid control in the hospital it was possible to reduce the insulin to 35 units. This patient's tolerance is not stable and during the school year is always lower than in the diabetic camp.

A diabetic child whose disease is known to have been present for at least 2 years and whose tolerance was rapidly growing worse was operated on. The child made a rapid recovery. Four months after the operation a red cell count of insulin could take place. Five months after the operation the high carbohydrate level of diet was changed to a low carbohydrate high fat diet with a large reduction of insulin. A little later a chickenpox infection upset the sugar tolerance from which the patient 3 months after the infection and 11 months after the operation is gradually recovering.

In a disease of life's duration with spontaneous fluctuations with such sensitive response to infections and emotional influences we can not be too cautious in interpreting results. It is true that the result in either of the two cases operated upon is not a fair example of what can be accomplished with the method. In the first patient the presence of a small hypoplastic tail of the pancreas prevented the isolation of a large enough portion of the gland. In the second patient as pointed out by Wilder the high carbohydrate diet which

has been given according to Lorges and others to stimulate insulin production might have been injurious and that better results could have been expected if the pancreas had been allowed to rest rather than being stimulated in the period when the islets were undergoing hypertrophy. Insufficient time has elapsed in both cases to predict the ultimate result.

Nevertheless the animal experiments and the observations in the two clinical cases show striking parallelism. The increase in tolerance is gradual, occurs around the fourth month and does not persist at its highest level but gradually diminishes. The assumption that an islet hypertrophy takes place in the diabetic child could not be verified up to date histologically but seems very probable.

This regeneration or even superregeneration of islets does not strike at the real cause of diabetes. Unless we will be able to protect these islets from injurious effects of nervous or hormonal origin the new islets will become exhausted like the original ones. If Epstein's theory of tryptic action on the islets were true the exclusion of external secretion from the tail would be particularly significant. If some other insulin inactivating agent were at work then a surgical attempt of islet regeneration alone would not lead to permanent results.

So long as the cause of diabetes is unknown a surgical attempt to improve diabetes can only have the following aims:

1. *A stabilization of tolerance* whereby the children are more easily controlled, less subject to acidosis and coma. In other words to transform the unstable juvenile diabetes into a stable type of the older patient. Both cases seem to show this effect very definitely.

2. *A reduction or possible abolition of insulin* on a liberal diet. If better utilization of sugar would take place on the same or less amount of insulin the better development of these children might be brought about. This second requirement has not yet been entirely fulfilled. There is enough suggestion however in the first cases to warrant further trial.

A report on other cases with a further report on the first two children will be made at a later date.

On July 11, 1931, the patient was taken off the high carbohydrate diet and given carbohydrate 50, protein 50, fat 215, a glucose value of 120. The insulin requirement fell to 3 units. The next week the insulin had to be raised and on March 23, 1931, a chickenpox developed with high temperature and extensive eruption. The insulin requirement rose to 50 units and his tolerance was upset for several months. On June 20, 1930, Miss Florence Smith, chief dietitian of the Billings Hospital, reported the following data: Diet carbohydrate 39, protein 75, fat 200, a dextrose value of 203 with 55 units of insulin. This was 3 months after the chickenpox infection started but the tolerance seemed to increase slowly (Chart 2).

onset of coronary thrombosis resulted in death before intestinal changes from occlusion of the superior mesenteric artery could occur

Nine of the 16 cases of venous occlusion in this series were primary or ascending and 3 secondary or descending the 2 remaining were of rather indeterminable type. In the primary type of case the cause most often lies in changes in the intestinal tract which permit the entrance of bacteria. Inflammation of the appendix was responsible in 3 cases; it was subacute in Case 15 and gangrenous in Cases 16, 17, 18 and 19, indicating that the more severe the appendiceal condition the more likely mesenteric thrombosis is to follow. Thus of 6 cases in which the gastro-intestinal tract was responsible for the vascular condition the appendix was the source of it in 5. In the remaining case (Case 20) severe enteritis was probably the initiator of the venous thrombosis. In Case 26 the presence of numerous suppurating decubitus ulcers was the probable source of mesenteric phlebitis which eventually resulted in thrombosis. Possibly involvement of the mesentery by the malignant condition in the pelvis could be a factor in closure of these vessels. Miscellaneous causes were noted in the 3 other cases of primary thrombosis.

In 4 of the 7 cases of descending thrombosis of the mesenteric veins hepatic disease was present: portal cirrhosis (Case 24), multiple hepatic abscess due to *Escherichia coli* (Case 23), localized hepatitis following a tear in the liver (Case 22) and extreme fatty degeneration of the liver (Case 21). The 3 remaining cases resulted from miscellaneous causes.

It may be noted that of all the cases of venous thrombosis 31 per cent followed appendicitis and 25 per cent were associated with disease of the liver.

Of the 16 cases of venous occlusion in this series intestinal infarction occurred in 13 (81 per cent). Of these 13 cases the main trunk alone was involved in 2, the tributaries alone in 3, and both the main trunk and tributaries in 8. In the 3 cases in which there was no intestinal injury the main trunk alone was involved. This constitutes evidence in favor of Reich's opinion that infarction occurs only when thrombosis has extended into the tribu-

TABLE I—CLASSIFICATION OF CASES

| | Cases |
|---|-------|
| Arterial occlusion | |
| Embolism | |
| From mural cardiac thrombus | 4 |
| From valvular thrombus | 1 |
| Thrombosis | |
| Mesenteric arteriosclerosis | 2 |
| Arteritis | 3 |
| Unknown or doubtful etiology | 4 |
| Venous occlusion (thrombosis) | |
| Primary or ascending | |
| From appendicitis | 3 |
| From enteritis | 1 |
| Secondary or descending | |
| Associated with diseases of the liver | 4 |
| Doubtful whether ascending or descending | 6 |
| Combined arterial and venous occlusion | |
| Following intestinal obstruction | 2 |
| Miscellaneous etiology | 4 |

aries of the vein and has reached the intestinal wall because branches which are free can open into the main vessels above or below the limits of the clot which the main vessels contain.

Six cases of co-existent occlusion of the arteries and veins are reported. In 2 of these the patients were aged and attempts at surgical relief of intestinal obstruction preceded the onset of the thrombosis. The significance of sclerosis of the mesenteric vessels is undoubted although traumatization of tissue sepsis and stasis may have been the precipitating factors. Other associated conditions found were metastatic carcinoma of the mesenteric nodes from primary rectal lesions, splenic abscess and so forth. In 2 cases definite etiology could not be ascertained.

A review of the literature regarding experimental production of mesenteric vascular occlusion indicates that ligation of the superior artery at its origin or at one of its primary branches results in infarction in the region of intestine supplied by the occluded vessel. In intestinal injury usually does not result from a ligature applied distal to the anastomotic arches. Severing of the mesentery is without effect unless more than 3 centimeters is cut away and when the omentum is wrapped around the intestine from which the blood supply has been ligated gangrene may or may not develop. Ligation of the mesenteric veins is not always followed by infarction although this is more likely to be the result than ligation

MESENTERIC VASCULAR OCCLUSION¹

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F L W C g r y Th M y F 11

OCCCLUSION of the mesenteric vessels is generally regarded as a comparatively rare condition however it occurs often enough to require consideration whenever obscure acute abdominal lesions are encountered. It is the severity of the condition and not its frequency which makes it significant. Owing to the difficulty in its diagnosis and the usual conception of its rarity many cases undoubtedly remain unrecognized clinically and death is ascribed to postoperative ileus peritonitis and so forth.

The first case of mesenteric vascular occlusion was recognized and reported by Tiedemann in 1843 and an extensive pathological study of the affection was made by Virchow in 1847. The latter described closure of the superior mesenteric artery resulting in an intestinal infarct. Seven years later he described a similar case. The clinical aspects of the subject were not accorded much consideration however until they were emphasized by Kussmaul and Gerhardt in 1863. Thereafter reports of cases were recorded by many writers. In a comprehensive monograph in 1913 Trotter analyzed the 360 cases already in the literature and added 6 new cases of his own. From a careful study of these cases he was able to draw valuable conclusions. His statistics show that a preoperative diagnosis was made in only thirteen cases. From 1916 to 1918 various reports were published (1 2 3 4 5 6 8 9 10 11).

REVIEW OF CASES

Thirty six cases of mesenteric vascular occlusion in which necropsy was performed are presented as a basis for this paper (Tables I and II). These may be classified as follows: arterial 14 cases (39 per cent), venous 16 cases (44 per cent) and co-existent venous and arterial 6 cases (17 per cent). These percentages are in rather close agreement with the relative frequency as found by other authors.

Arterial occlusion may be due either to thrombosis or embolism or a combination of both and when the closure is complete in either of the superior or inferior mesenteric arteries the resulting injury is of a serious nature. This is due to the fact as has been explained by Klein that the mesenteric arteries are end arteries functionally but not anatomically. Incomplete closure of the vessels is not so serious and is probably the origin of symptoms described as mesenteric intermittent claudication. This narrowing and sclerosis of the arteries of the mesentery give rise to attacks of nausea vomiting flatulence and abdominal pain many times finally resulting in complete occlusion due to the formation of thrombi. Case 7 of this series illustrates the sequence of events in cases in which incomplete closure of the vessels takes place.

Intestinal infarction resulted in 12 of the 14 cases of occlusion of the superior mesenteric artery. No case of occlusion of the inferior mesenteric artery was encountered. Arterial occlusion from thrombosis was found to be slightly more common than from embolism the number of cases of each was respectively 5 and 4. Three of the 4 cases of embolism resulted from cardiac thrombi and 1 from a valvular thrombus. Periarteritis was present in 3 of the 5 cases of thrombosis and arteriosclerosis in 2. The 5 remaining cases of arterial occlusion are of doubtful nature although a mural thrombus may have been present and overlooked in Cases 11 and 12. In Case 13 a severe septic process in the genito-urinary tract may have been a factor as this could well be a focus of infection for mesenteric arterial thrombosis. In the 2 remaining cases pathological changes in the cardiovascular system were not recorded. Arterial occlusion did not result in intestinal changes in 2 cases. In Case 11 the short time between the occurrence of the mesenteric embolism and of the cerebral hemorrhage probably accounts for the absence of infarction and in Case 4 the

Abstr. f. these b m ed f h f ul f h G d te School f h Unive ty f Min nesota f f fillm f th equ m
f th d gree f Mas f Arts in P f h g r y J 9 W k d o m th Departm f f thol gy University f Minnesota.

TABLE II—Continued

| C se | Age Years | Clinical history | Observations | Comments |
|------|--------------|---|---|---|
| 15 | 60 M | Fp ga tr pain bd mu ld t to l se er ld ys d th d y ft a d sympt ms (gen) (perit u) | Gast o test f t t mal pt f cax l b cutely a flamed ppe dux p mes t d po l t e dist d d d oc l d by th mb soo m gras h y ll w f d pe t l ty | So ppendi |
| 6 | 5 M | Onset w th dd p l w po b f bd m w th muting d gn f shock d th soo ft dmuss t hosp tal | I f t f t u j l m and l m mesent r d ll ts t b ta es pl gged by thr mb oo m f bloody f d petit m l g bs ess pelvis d tly f ppendi l | So i bs es f p pe d l g |
| 1 | 3 M | Ce bd mu l p d d t t f a days t p t f j d ya p d d hy d rihora d th w th gn l g al penit u | Ge l p e t t f t t t t l um g gr pp d thr mbos f essel f mese t ry respo d g t farcted g | So ga gr p pe d |
| 18 | 47 M | Sev pai right w q dra t f bd m f w le ppe deci my tw th d y ft t t wh h ppe d t d acut ly flamm d b mese-appe d d soo d post per t arrest my with m h bd m lp n d th tw ty-akth d y ft pe t with ympt ms fpe to t | Ge er hzed p t t soo cm p b d m l ty t u f s m f l m d ve esp l g m oc l ded by th m b mult pl mall h p t bs ess | So bs es f meno-appendi d p p d t u w th t mat t f d f th f bases es |
| 9 | 76 F | F ev ld yat d es right w bd m al quadr t w omat g d rihora d bs l t bstru t th gn f gpe t i d d th day ll set | Ge lp t nts f t f m f l m ppe dux t a g gr d p f t d lpl es with l g po k t l p hbo hood | Sour cut ppe d lia |
| | 60 F | Co t p t f week use mut g d diff se bd m lp f d ys d mitted hos- p tal hock l f m yan t d ld d l ft b chul t r y p lp bl as th k d | D tal m f l m f t d cut ppur t r us rr po d g gn right p l m ty r y rr mese ter p tal and l ab h l t r y oc l d by th mb soo m f l blood per t ty | P b bl sour t pp tv ter t |
| | 31 M | N h l d t a d bl | I f t f t r j s m pe mese t n n oc l d by th mbus t d g t po l l ma k d f t y m tamo phos f tur lve soo m d k blood-stal d fund per t t l ty | I l p tu disease with tagm t n po tal yst m |
| | 6 M | P t th d h d d f gall bl d d f a mbe fy th l w t t mpting m ve th g ll bl d d th occur d se th d y ft p t with ympt ms f p t us | I f t f loop l f eum l f pe mes t n in by th mb ch f cy ut d h l l th f ted l t d h p t b t ea g ll bl d d | Th f ted h p t w d f d thr mbos f d th tr b laries f th po t i un |
| | 3 M | Ch lls l y mut g bd mu l p d d hox l ted w k th l b m lag d d j d ppe d d th occur d 3 day fte nset with ympt m f penit ut | P l t thr mbo f th po tal d p mes t m l upl h p t b sees soo m green h f d bd m l ty es h h l d f m th p | Hep t bs es with sep po l l t m ult d thr mb |
| | 4 M | F ev ald sev g l d bd m lp w p se t most mark d ght w qu d t a d d tent d v mut g d pp d t my w d and p t d d hock s d y ft p t | Inf t l t l l um d l m d p m l part f t crespo d g mall oc l d by th mb b t mal ban hes f l t ritonatus l nl ged La rthosa (65 gm) | So f m m t trib tary f po tal t m p mpo d tas d t h pa t rrr |
| | 5 M | F t ent f d l m t p u s d hema m mes f d y bdom w d d d d d d d smooth m w p p l b l t bel w th l f ostalm g 75 m f g gr tests w t d th p u t d d 48 h ur ft p t | I f t f s m f th mudd po t f th l m oc l n f esp d ing un by th m b th mb l pl d po tal small m unt f bloody fluid p t al ur plee larg d d d b t to ur und g tr ct | So possibly thr m bos f pl with pl m g ly d dary th mbo f th po tal d mes t |
| | 6 k | O t w th dd bd mu ald t t hght m per t d p d pbe sy p t dnu hy t ectomy was d f ter an ma th p u t was v ry ma t d dw k d d d with h ur f m th set t th t m f death th w b g f g vnd f m t lass to th pel bs | I f t f l um d acuum occl sin f p d g w with th mb m y inf t d d b t al | P ss bl us mes t phl b tis |
| | 7 F | O th fifth day ft m d l l ry th p t e t bdom be m ma k dly d d d d t d d h nut d f o ntly m was p lp bl d ght l w bd m q d t l p lomy nly w d p t d d d th s th d y ft r d l ery | Infar t n f l m f cae al al d f acuum d ddes d g l th mbo is f po d g | So was flammat ry p oc ss tr d d t l bo |
| | 8 F | Ons twas with sev diarrhoea and bd mu lp l t t ther was fcy and l t f p b e n d f m t m w p lp bl t l f t de f th bd m pati t d d l r d y | P nmal oo m f l m f l far t d uns p d g g as fill d with t t soo m bloody fluid pe t l vity | E d f f t u p ocess t ted |

TABLE II—ABSTRACT OF CASES

| C | Age | Chief history | Observations | Comments |
|----|-----|--|--|---|
| 6 | M | Acute set face, head, full, well, by h k m l, w g d p d pul sol d fin t m palp bl l w l f q d t f hd m l p my 45 h l t t d d th h ur late | H t h t f h y p e t w m l h m b o f l f t t o o c m b l o o d y a s t g f l f t t f t h d r s f d o d m t h j j m e l u m d l t p l g b y m b o l d t h m b c m l g | Origin f m b o l f m l c a r d i a t h r o b |
| 6 | M | O d d with h mat m d p sag f f o u l d u n h f l l w d b y h d m l d i s t t o d d t h 3 h u r l t p t h d h d l t a k l d p t s y | H t h t f h y p e s o w t h y s e d e r n m y d l l a r d m l t h m b u s l f t l f t c f l a t g m f l e u m d l o c l p t w h i m p o m d i g t l d d b y t h m b | O g f m b o l m l t C a s e |
| 3 | M | S d d t t a k f s e b d m l p w h i t b e t d f t e m b o h o r d m a t i s o o f l l w d b y m i g f l i t m p e p i s e d u f b d m d h o c k d h s d a y f t t | C o r y l o s w t h m l t h r b o s f l f t t r l a w t d m m m d h h s m l g h w b l b y t h m b l p o d i n g r e d | Origin f m b o l f m l a r t C a s e t h r m b w e d r y t o t e s t l |
| 6 | M | P u t d m t d h o s p l h k h d b d s e l p d i a l p a t r y d p o e d j l t h d t h j m d l t d m | H t h t f h y p e t w t h o r y l e r o s d m l t h m b o d l f t r u n d h p t g l i o l v e m a l g t r o t e s t t l g f p o r m e s e r y b y m b o l g t h m b u s | D t h p h b l y f m d t h r b e l l d p e r v |
| 5 | M | P t e d e t a m t h p t a l l d d m p n s a w m p w g d d l l w h h d d d d s e v b o m h k h u r l s d h y b p l s e w h k h u r l w h h d d | V l u d t h m b f l f t t r a l g e n e r l d l a r f j j m l m a n d g h t h l l l o n d b u p o t u b w l t a d b l b l o o d m a t l p e o m t y o c l d d t g b y l a g t h m b t d i n g t m a b h e s | O r g f m b o l f m d v a l v u l a r t h r m b |
| 6 | M | P u t h o s l i f f r t h t a k d s d m p g t b i g m p t a d i t t u r s g i d y l e r d d p m d b d m a l p m m u g d p g r s d m l d i s t a l g n o g e n l p e t o n t d l p d p t d i d n 3 h u r | P l l y l l m a l l t e a n e l l t e d d t p e t o n l m t a r y d d t r e s b y h m b p e p o s e d m a r k d t e r o c t t h k m g f t h | M l t t e o l o d t h m b o s |
| 7 | F | F d y p t t h d h d m u n g p g r e s d y p p g l d f t e m p l d p m d t h r d f t m d i c a l n o a m u l a t t a k h d d i f y r s h e y f i m y p e f m d y y b e l d m a s | I f t u l u n m l m d p m i p a r t t m l t t m e a s e r y b t o c l t t h k g d p e m p o e d t h m b | L e s m u l t C a s e h t r y d t e p e t c l d u r t o |
| 8 | F | A d y t e w i f f f t d d m d j t f r y d d b o m l p d e h l p e d t h m g d p u l s e l d h u r r d y d y f t p w i t h g n f g l p t u | G l p e m u s h t h l b w h p p e t o n l t f t u f m f l m e n h m a p e l t p e m f m r y k l d b y t m b t a r t u m f m m f t r y p f a r t a n l f i k d y d p l e e | G e e r l i s e d p h p b b l |
| 7 | M | P t f d u n f e e t p g b l o o d l l m a e n l d d w y t h p t a l | I f t u f l e m d l g p t f l f f p e m d u n g t h m b f l l f p p e p a r t e r y | S e f k g |
| 6 | M | P t h d e v b o m l m u t i g d l d m u t o h o s p t a l | I f t f g m f d t a l p a t f f m o c l f o s p e o r m t r y b g r g m d t a l t r u n d t e d g m a b h m l t r t o s i m t u s t l y m p h y t o o m b l o o d y t f l u d | E l i g y m l t C a s 8 d p |
| F | | P t t B l o o d p e s s d o o y a t h f a s d t h o c c u r d d l w i t h t b d m u a l y m p m w h u l p t u e w a t u n g p a b d | E t r g t e t e s t a l t r t m a l p p e a r p e r n m t r y o c l d d g b y h m b s h b l o o d i n p e t o a l w i d d t h m l g e r b l h m h g | I d m i n t u l e y d h b f i n l k p l |
| 25 | hl | O s e t f d d b d m l p a n n d e n t i a d m u g p a t p d l w a n h o c k u r l a r f i b r i d a t o o c c u r d | I n f a r c t i t l e a n t h m b o d l f p m a s e f a r t r y d b h o o m l u r b d f l u n d i n p e r t l v y | P b l y l t h r m b |
| 0 | M | P f e e b l d e g a l b d l m p l o e w a s d e a t h i n d a h d b e g t h r t m f b o t y f p y e l p h t u s a n d p h r l h a | G e l p e n t i o o m b l o o d f l u n d i n p e t o l w t f t t u t h m l b o s f l l m e s e c a l d l u s p e s o m e s t e r t e s g b t h m b g h t p y p h r w i t h a l b | S f m p y i s g n a t i g f m p y p h |
| 2 | M | O n s e w i t h v o m i t u n a n d p a s f i w r y p o l s s e v e r b d m u a l p a n m o n m k d l w r y l i q u a d r f d a y d h s o o j d m u | I n f f a s e r b l a d e d a l m p e t o r m e s t a s a o m f t h m a l l b h | M l o s d b y t h m b t l s |

TABLE III—SITUATION OF INFARCTION

| | Arterial changes | Venous changes | Arteriovenous changes |
|-------------------------------------|------------------|----------------|-----------------------|
| Infarction of the jejunum only | 1 | 1 | 0 |
| Infarction of the ileum only | 4 | 7 | 3 |
| Infarction of the jejunum and ileum | 6 | 2 | 2 |
| Infarction of the ileum and colon | 1 | 3 | 1 |
| No intestinal changes | 2 | 3 | 0 |

TABLE IV—PERITONEAL CONTENT

| | Bloody fluid | Clear fluid | Necrotic | Fetid |
|--|--------------|-------------|----------|-------|
| Arterial occlusion | 8 | 2 | 2 | 2 |
| Venous occlusion | 8 | 2 | 3 | 3 |
| Combined arterial and venous occlusion | 4 | 0 | 1 | 1 |
| Total | 20 | 4 | 6 | 6 |
| Per cent | 55 | 11 | 17 | 17 |

TABLE V—INCIDENCE OF PERITONITIS

| | Local abscesses | Generalized abscesses | Stat dead |
|--------------------|-----------------|-----------------------|-----------|
| Arterial occlusion | 7 | 3 | 3 |
| Venous occlusion | 1 | 5 | 6 |
| Combined occlusion | 0 | 3 | 0 |
| Total | 8 | 11 | 9 |
| Per cent | 22 | 31 | 25 |

TABLE VI—DURATION OF SYMPTOMS

| | Seconds | 1 day | 1 to 6 days | 7 to 14 days |
|----------------------|---------|-------|-------------|--------------|
| Arterial obstruction | 10 | 91 | 1 | 9 |
| Venous obstruction | 8 | 57 | 6 | 43 |
| Combined obstruction | 6 | 100 | 0 | 0 |

severe colicky abdominal pain (5) later distention of the abdomen with tympanites and shifting dullness and (6) embolic phenomena elsewhere in the body.

The tendency of arterial and of combined arterial and venous occlusion is to run a more rapid and fulminating course than that in cases of venous occlusion. This is illustrated in the 31 cases of this series in which the duration was stated (Table VI). In addition venous thrombosis is more likely to be a condition of more vague symptomatology and interwoven with signs of preceding disease.

In the differential diagnosis one must consider other forms of mechanical obstruction such as volvulus intussusception stenosing malignant lesions of the colon and also acute pancreatitis or ruptured abdominal viscus. The prognosis in this disease is practically 100

per cent fatality without surgical intervention, and even with surgical intervention only occasional cures may be expected.

SUMMARY

A review of 36 cases of mesenteric vascular occlusion in which necropsy was performed is presented. The patients were aged 22 to 78 years the average being 57.2 years. In 26 cases the patients were men and in 10 cases women. The most common cause of arterial embolism was mural cardiac thrombi. The most common causes of arterial thrombosis were arteritis and arteriosclerosis of the mesenteric artery. Venous mesenteric occlusion most often resulted from a septic process either in the gastrointestinal tract or the pelvis and was of the ascending type. Less often it was a descending process caused by thrombosis in the portal vein. It followed hepatic disease in 25 per cent of cases. The vascular occlusion affected the arteries in 14 cases, the veins in 16 and both veins and arteries in 6. In all cases of arterial occlusion and in all but one of the cases of venous occlusion the superior mesenteric vessels were involved. A definite source of the vascular occlusion either was unknown or was problematic in 8 of the 36 cases. Hemorrhagic infarction resulted in 31 of the 36 cases. When intestinal infarction took place it was generally manifested by symptoms of intestinal obstruction which were indistinguishable from those of other types of obstruction. Typically it occurred in an elderly person starting with extremely severe colicky abdominal pain, nausea, vomiting and diarrhoea. The vomitus and the diarrhoeal stool were often mixed with blood. Occasionally complete retention of feces was noted. Soon the pain became steady, the shock more severe, the abdomen distended and tympanitic and the temperature and pulse which at first were likely to be subnormal became progressively elevated. Later signs of general peritonitis developed and death took place. In a few cases an abdominal tumor could be palpated. Arterial occlusion and combined arterial and venous occlusion presented symptoms which were usually more acute and fulminating than those of venous closure. The symptoms produced

TABLE II—C t ued

| C | Ag | Cl | h to y | d b r v t | Observa t p y | C m m t |
|----|-----|--|--------|-----------|--|---|
| VI | | Aft m th f bd m l mp p g a s t p hull d f se bd m l p h m t m d d t dd l d th lt d days | | | E g a s t o t e s i n l t r t m a l t h w a s r y l d t h m b o f t h p l n i f m s e t e d t h v e h m a h w e l y h m b o s e d t h p e m s e d p c a l w f f t | C l l a l l i o n o d b t w b l h d t b t w b l h d t b l d e m o |
| VI | | Se bd m l p m t g d m p l b r u w p a e f d y m k d d d t h p r v i h p t w t t h k d d d y f f s e t | | | I f t t f t h d t a l t w o t h u r d f h m l b o w l t h c u m d t h p m l p t f t h d g l k m b o s f t h r r e s p o d s e l g l p s m y d l c a f t h l f t t l h l d f t f k j y | S o p b b l y m b o l m f t h m s e t r y f d o n g |
| 3 | 6 M | Lap t m y d f c u t e t l b t r m l b d w l s e d m m d t l y f p e m u d f p p e a d d t h c u r r d d y f t p | | | I f a r t f s m f l m b o t s m f m d h l l t h m b o f l l r r e s p o d g m e s e t s e l g l p e s o o m f b l o o d y f d b d m l v i y | T h m b d f t f l l d e s l b t r u t |
| | 6 M | T h h t r y w f g u i d h t e t d f d y f p l d p m e t f p p u l y b l b w l y m p m f t b t u p e r s d d t h p t d i d s d l p e | | | I f t f l o o p f l m l h y g s m f m m f m t h l l r r p d g m e s t l d d b y t h m b | E t l g v m l C s e 3 |
| | F | S d d s e t f s e d g l d b d m l p d m h f s e d m k l p d t h | | | I f c a l f s m f l m l y g s m f m s e l s o o t h r m b f e s p d g s o o m f b l o o d y f l u i d | N s e f t h m b o w d m t b l |
| J | M | O s e w i t h d d b d m l p m g d h d m p e m b p v l l p t u f t m d h d d m e y m f b m t d t h c u r r d d y f t f t t a k | | | I f t l w p t f j j m p t l m t o s f i l t r f m e s e r y d t a s e l b y m l g n t | T h m b o s d t o l l b y m a l g n g r h |
| 35 | 8 F | O s e t h d d u s e m g o l m p f l w d b y s e l w r y o l m p g f l b d o m f f o w k t h p h d f d f m d d e c o m p s a d h m u d 48 h f f c u t e y m p t m | | | I f m f j j m d l m t h m b o m t m t r y d l m b h b y h m b g l a z e d p e t u l o d o c l d d | E m b o l m e s l g f m c u l b m b o s d r v t b m b o s a s e f t |
| 36 | 6 M | P t t h d b d m l p d t t d m u m u l s d h w m b d d m u t h o a t a l d d s o o a l e w a r d | | | I f f d t l s m f l m p p e n d i p m l m c u m d a s e d u n g l h m b o s f m s e t h p m t f t t h p m t t a g u w b h w a s l d b h k d l w l d h m b g l d p t o t w h o o m f p h p o l v i t y b e s f l e e | T h m b p b b l y f m d b a s f l d l o e f m b o s f l l g e s l n f |

of the corresponding artery. Experimentally lesions varying from extensive intestinal infarction to slight ulceration of the mucosa may be produced. The pathological changes noted in the 36 cases are given in Table III.

An infarcted coil of intestine characteristically contains a fluid or semi solid material varying in its content of blood. It may be almost pure blood. Gangrene and peritonitis is the almost inevitable end result in the cases in which resection is not performed. Bloody peritoneal fluid when present is almost a pathognomonic sign of gangrene. The peritoneal fluid in the cases of this series was found to be as is recorded in Table IV.

Intestinal perforation is uncommon in this condition. It was found in only 1 of the 36

cases. However peritonitis either localized or generalized is commonly found (Table V).

The symptoms of this disease may be either acute and fulminating or of gradual and phlegmatic onset. At best the symptoms are practically the same as those of any intra-abdominal catastrophe and the diagnosis between arterial and venous occlusion is usually impossible.

The postulates of Kussmaul and Gerhardt regarding conditions which should be present to justify a diagnosis of this disease may well be quoted here for they agree closely with the phenomena found in this series: (1) a source of an embolism (2) melena not to be accounted for by a primary intestinal lesion (3) rapid and excessive fall of temperature (4)

in the anesthetized cat while being supported by an iron block were repeatedly struck with a blunt wedge shaped hammer or they were crushed by compression. The trauma usually failed to break the skin so that infection from without was impossible. After about 20 minutes the blood pressure of such animals began to fall and after about 1 hour it had usually fallen to shock level. That the toxic material is carried in the circulation was demonstrated by Cannon in the following manner: the blood vessels of the leg were ligated before the muscles were crushed and the ligatures were left in place for 33 minutes after the trauma, during which there was no fall in blood pressure. However as soon as the blood flow was re-established the pressure promptly fell to a low level.

In previous reports (7) we have called attention to the changes produced in blood pressure by the intravenous administration of saline extracts of fresh tissue. Figure 1 shows a record of blood pressure and respiration obtained from a dog. The changes in blood pressure level are due to the intravenous administration of a saline extract of fresh liver. The extract was produced by grinding fresh dog liver with an equal amount of physiological salt solution; the ground mass was then filtered and the filtrate used while fresh. Administration of 0.5 cubic centimeters shows a definite fall in blood pressure while the injection of 10 cubic centimeters gave a marked lowering of blood pressure. It will be noted that the normal blood pressure was 60 millimeters above the base line and the lowered blood pressure recorded less than 30 millimeters above the base line. With the exception of suprarenal and pituitary extracts all fresh tissue extracts possess this property of lowering blood pressure.

Mason has previously (6) called attention to the extreme potency of fresh tissue extract in the production of intravascular coagulation (thrombosis and embolism). If three drops of fresh lung tissue extract be injected into the circulation of a rabbit it will produce coagulation of all the intravascular blood in about 20 seconds. All the fresh tissue extracts share this potency, but the degree of potency varies with the tissue used. The actual amount

of fresh tissue extract necessary to produce death, through thrombosis is very small; such extracts contain 3.65 per cent solids, 0.9 per cent of which is the salt added. The actual solids in the crude preparations is not more than 2.75 per cent. Since only 3 drops is necessary to produce complete thrombosis of the entire vascular system, the actual amount of crude material used is only 0.055 grams.

ACTION OF EXTRACT OF AUTOLYZED TISSUE

If a small piece of liver is deprived of its circulation and is left in the abdomen, the animal will die, death usually occurring in 15 to 18 hours (7, 8, 9). We have recently studied 16 more animals in an attempt to determine the nature and action of the toxic material generated in liver tissue deprived of its circulation. If the partially autolyzed liver is removed at the death of the animal and ground with salt solution, it yields an extract which possesses properties different from salt extract of fresh tissue. Figure 2 shows a record of blood pressure and respiration obtained from a dog. It will be observed that the amount of extract injected was the same as used in Figure 1; however the blood pressure response is quite different. There is an initial fall of blood pressure in both records, but with sublethal doses of the autolyzed tissue extract the blood pressure always returns to a higher level than before the injection. In previously published work (8) we have shown that the heart becomes irregular with small doses, and we have also determined the fatal dose to be about 7 to 8 cubic centimeters. Figure 3 is presented to illustrate the effect of injecting 10 cubic centimeters of the extract of autolyzed liver. It will be noted that the dog died almost instantly. The death produced by the administration of extract of autolyzed liver occurs after destruction of the central nervous system and paralysis of the vagal endings.

USE OF TANNIC ACID

While studying the toxic action of autolyzed tissue, our attention was focused on the toxic condition accompanying burns. We early conceived the idea that absorption of the products of decomposing dead and dying

by closure of the main trunk were indistinguishable from those produced by obstruction of the branches. The course of the disease is short and may be less than 48 hours. In at least 53 per cent of the cases definite peritonitis was present and in 55 per cent bloody ascites was noted.

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AUTO-INTOXICATION AND SHOCK

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IN recent years the problems of the surgeon have become more varied and quite complex. Previously the surgeon considered that he had discharged his obligations to the patient when he had removed the pathological process controlled hemorrhage and avoided sepsis.

The thinking surgeon of today realizes that the outcome of an operation may depend as much upon the condition of the tissue left in the body as upon the removal of the pathological tissue. The history of surgery shows a gradual development of respect for the tissue surrounding the operative field. The rapid operation generally necessitating rough handling of tissue and the use of wide jawed clamps has given way to a more delicate technique and the use of the narrow jawed clamp. Some operators have even gone so far as to handle tissue with ligatures using clamps only when absolutely necessary.

The experiences of the war did much to reveal the dangers from absorbing extracts of freshly crushed tissue and extracts from auto-lysed tissue. It soon became evident that a

wound freed of dead and dying tissue gave the patient a much better chance for recovery.

DEFINITION OF TERMS

The term auto intoxication is usually used to denote a toxic condition self imposed which develops through the absorption of toxic material from the gastro intestinal tract. In the following discussion the term is used to denote a toxic condition self imposed which develops through absorption of extracts of body tissues. Such auto intoxication is presented under the two divisions (1) that produced by extracts of fresh tissue and (2) that produced by the extracts of autolyzed tissue.

THE ACTION OF FRESH TISSUE EXTRACTS

In 1922 Cannon published his splendid report on Evidence of a Toxic Factor in Wound Shock. In the study of wound shock Cannon described his experiment as follows. In order to bring about in lower animals a traumatization similar to that giving rise to shock in man the thigh muscles

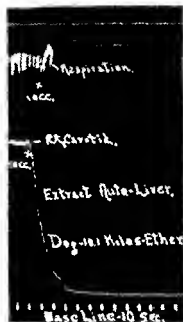


Fig 3

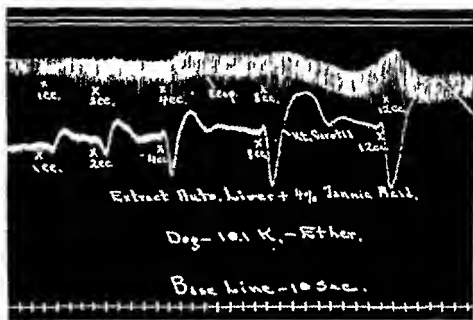


Fig 4

Blalock after the injection of histamine. Trauma to the extremities did not produce any alteration in the gall bladder.

The observations of Blalock have been recently confirmed by Parsons and Phemister. They stated 'Traumatism of a limb of a dog producing fall in blood pressure is accompanied by a corresponding increase in limb volume and anemia which are due very largely to hemorrhage into the damaged tissues. In these experiments it could not be demonstrated that a toxic substance liberated from damaged or asphyxiated tissues or extravasated blood of the limb was absorbed and produced a sustained fall in the general blood pressure.

It is difficult to reconcile our findings with those just presented. We suggest that in the studies involving the use of crushed muscle the conclusions were formulated due to one of the three following reasons: (1) the tissue extract from the fresh tissue failed to reach the general circulation; (2) the tissue was not allowed to undergo autolysis; or (3) muscle tissue does not yield as toxic a substance as does skin or liver tissue. The figures in Table I represent the changes in weight of liver tissue left free in the abdomen until it caused death (15 to 18 hours). The first column represents the amount of liver sectioned at operation, the second column the amount of liver at the death of the animal and the third

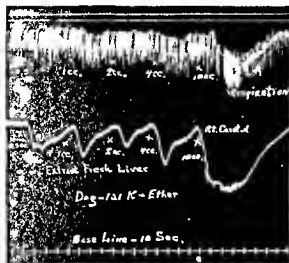
TABLE I—CHANGES OF WEIGHT IN LIVER TISSUE LEFT FREE IN ABDOMEN

| Fresh liver gms | Atlyder K m | Difference g m |
|--------------------|----------------|-------------------|
| 28.5 | 15 | 13.5 |
| 46.6 | 35 | 11.6 |
| 34 | 18 | 16 |
| 50.5 | 28 | 5 |
| 61 | 43.5 | 17.5 |
| 36.5 | 26 | 10.5 |
| 65.5 | 45.3 | 20.2 |
| 84 | 61 | 23 |

column the loss in weight. It will be noted that a loss in weight of as little as 10.5 grams of liver substance caused death, probably only a small fraction of this was absorbed by the animal. Therefore it is evident that it requires



Fig 5



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tissue contributed largely to the cause of death from burns. Davidson, acting on the suggestion of Mason, instituted the use of tannic acid as a treatment for burns, the object being to precipitate the products of decomposition brought about by the destructive action of burns. The splendid work of Davidson, which has been so completely confirmed by many subsequent workers, has proved the value of such a method of treatment.

Assuming that the autolysis of skin and the autolysis of liver liberated the same toxic substance, we have studied the toxic action of the autolyzed liver treated with tannic acid. Figure 4 shows the effect on blood pressure and respiration produced by the filtrate of the tannic acid treated autolyzed liver extract. We used 4 per cent tannic acid solution in order that our resultant mixture would have a concentration of not greater than 2 per cent tannic acid, which is the concentration of tannic acid used in burns. The filtrate was water clear and doubtless contained but little tannic acid.

It will be noted that the filtrate was still very potent, causing a steady irregular pulse followed by a marked rise in blood pressure. It is evident that tannic acid removed little, if any, of the toxic element. The action of tannic acid administered intravenously is not similar to the results obtained in Figure 4, but varies considerably with the amount injected. Figure 5 is presented to show the



Fg

effect of administering doses of tannic acid large enough to kill.

DEDUCTIONS

During the past year Blalock has repeated the experiments of Cannon and Bayliss in order to try to determine whether the low blood pressure produced by trauma to one of the extremities is due to the formation of some substance which exerts general bodily effect or whether it is due simply to hæmorrhage locally.

His summary contains the following: The blood pressure could not be reduced to a shock level by trauma to one of the posterior extremities without causing the loss of a sufficient part of the blood volume into the traumatized area to account for the decline in the pressure. Blalock dismissed the role of tissue extracts by saying: A great deal of work has been performed to determine the effects on the blood pressure of the injection of extracts of various tissues of the products of autolysis of crushed muscle and of many other substances. Most of these substances caused a decline in the blood pressure. No evidence for the action of these products was found in the present experiments. Many of the substances which were studied are supposed to be fairly closely related to histamine. Good pasture found that a fresh extract of the pancreas produced changes in the gall bladder similar to those observed by Bradburn and

CLINICAL SURGERY

FROM THE SURGICAL CLINIC UNIVERSITY OF LYON

THE KEHR SUBSEROUS OPERATION

PROFESSOR LOUIS TIXIER LYON FRANCE

Professor of the 1st Chair of the University of Lyons

THE Kehr subserous operation applies a principle of surgical technique essential to complete any abdominal or intraperitoneal operative procedure that is the peritonization of the bleeding surfaces and the shutting off of the field of operation with peritoneum. It is true peritonization of the pelvis is an indispensable final step in hysterectomy, is possible but is it possible to peritonize the lower surface of the liver after a cholecystectomy and the opening of the bile duct, and at the same time to leave a passage for drainage of the hepatic duct? Since 1908 we have shown that this step can be accomplished in about half the cases.

Our modification makes it possible to abandon the Kehr subhepatic tampon. The Kehr tampon is an essential feature of the Kehr method the object of which is to create a subhepatic barrier by means of inflammatory adhesions which are formed at the expense of the neighboring viscera thus allowing the subhepatic drain to pass out. The Kehr method has all the immediate and late disadvantages of a Mikulicz operation: all surgeons know its defects and for this reason they will not be repeated here.

In our modification we use a simple continuous serous tunnel to carry out hepatic drainage. A few days after the drain is removed the hilar fistula closes by adhesions formed between the two walls of the serohepatic tunnel.

TECHNIQUE

The operation is performed in 3 stages: (1) incision of the wall and liberation of the gall bladder; (2) subserous dissection of the gall bladder and the cystic duct; incision of the bile ducts; exploration and removal of calculi from the chief bile duct; insertion of hepatic drainage; retrograde cholecystectomy; and (3) the making of a serohepatic tunnel around the Kehr drain; the fixation of the lips of this serous tunnel to the parietal peritoneum and suture of the wall.

In the description of each of these stages we shall mention only the details which differ from those in the classical operation of Kehr.

First stage—incision of the wall and liberation of the gall bladder. Any of the classical incisions for opening the abdomen may be used or ordinarily use the Kehr Hartmann type of incision. In this type of incision two cuts are made—one vertical and the other transverse—thus making it possible when completing the operation to choose the most favorable point at which to make the external opening for the serohepatic tunnel through which the Kehr drain comes out.

The vertical incision is made at the external border of the rectus; it is an exploratory incision passing into the abdomen and making possible the confirmation of the diagnosis. If it is found that the Kehr operation is necessary, a transverse incision of the rectus is quickly made with scissors between two fingers introduced into the abdomen. This incision gives access to the subhepatic region.

The gall bladder is liberated and three large compresses are inserted: an internal, a median and an infero-external one. An ordinary retractor is used. The liver is exposed.

Second stage—subserous dissection of the gall bladder; the cystic duct and the junction with the common duct; incision step by step of the bile ducts; exploration; removal of calculi from the chief bile duct; establishment of hepatic drainage and retrograde cholecystectomy.

The bottom of the gall bladder is grasped by the assistant with his fingers or with a tenaculum and the lower surface is brought up for incision. If because of the presence of much liquid the gall bladder is under too great tension or the walls are too thin it may be advantageous to remove some of the liquid by puncture. However the following chief step of the operation can be performed better on a gall bladder under moderate tension than on a flabby one.

only a small amount of some tissues to cause death. Also the decreased mortality rate with the use of tannic acid in treating burns strongly suggests that its value lies in the precipitation in insoluble form of decomposed tissue.

Andrews Thomas and Schlegel, discussing the experiment of Ma on et al. done in 1924, wrote the following: "These experiments have been criticized on the assumption that this procedure killed the dogs by producing peritonitis, but we have repeated them, inserting the bits of liver into the chest and into the axilla and have had the same results. Very recently Ellis and Dragstedt have reopened the subject and have concluded that death accompanying free liver tissue in the abdomen is due to an anaerobic bacillus. From the experimental data presented we do not think that these authors have sufficient evidence on which to base their claim. They killed their animals at the end of 15 to 38 days and demonstrated the presence of the organism which they claim causes the death of our animals in 15 to 18 hours. They further showed that fetal liver, both sterile and infiltrated with the anaerobic organism, failed to kill the dogs."

The marked rise in blood pressure following sublethal doses of autolyzed liver extract suggests a possible relation of foci of infection and hypertension. Possibly foci of infection liberate a toxic substance which elevates blood pressure.

CONCLUSIONS

1. Fresh tissue extract administered intravenously lowers blood pressure sufficiently

probably to endanger patients who are in a critical condition.

2. Fresh tissue extract is a very potent factor in producing intravascular coagulation.

3. Sublethal doses of autolyzed liver tissue extract causes marked circulatory disturbances, the lethal dose being 7 to 8 cubic centimeters for the dog.

4. Treatment of autolyzed liver tissue extract with tannic acid does not precipitate the toxic fraction.

5. The marked rise in blood pressure following sublethal doses of autolyzed tissue suggests the possibility that foci of infection may liberate a toxic substance which elevates the blood pressure.

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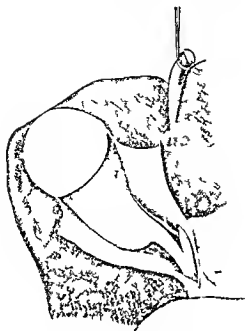
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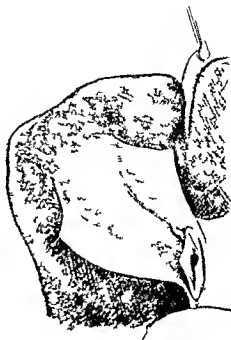
The gall bladder is liberated and three large compresses are inserted an internal a median and an infero external one. An ordinary retractor is used. The liver is exposed.

Second stage—subserous dissection of the gall bladder the cystic duct and the junction with the common duct incision step by step of the bile ducts exploration removal of calculi from the chief bile duct establishment of hepatic drainage and retrograde cholecystectomy.

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F R a k t t g t w f l s p t m
Sub s d t f t h g l b l d d r t h n f t h c y c
d c t a d f l l y f t h m m d c t



F R a k t t g t w f l s p t m
Sub s d t f t h g l b l d d r t h n f t h c y c
d c t a d f l l y f t h m m d c t

A semicircular incision is made in the serous covering of the lower part of the gall bladder at the junction of the anterior third with the posterior two thirds of the gall bladder. The proper plane of cleavage is found by making small repeated incisions. The serosa is detached with blunt curved scissors. As soon as the peritoneal flap is well circumscribed an anteroposterior longitudinal incision is carried to the semicircular transverse incision and is prolonged to the cystic duct. The incision takes the form of a racket, the loop the part surrounding the lower semicircumference of the gall bladder and the handle the part prolonged to the axis of the cystic duct.

The two flaps are detached either with blunt curved scissors or simply with small gauze tampons mounted on forceps. Small Chaput forceps serve as guides for the edges of the peritoneal flaps. Denudation is easier and more rapid as the region of the pelvis and cystic duct is approached. Hemostasis is carried out on some small transverse subserous arteries and veins.

The gall bladder which has been freed of its serous covering is carefully placed on compresses and the liquid is aspirated. A longitudinal incision of the gall bladder is made quickly and calculi are removed. By means of small blunt curved scissors introduced into it the cystic duct is slit along its lower surface down to its junction

with the common duct. This gradual progress toward the common bile duct is the most prudent method and prevents transverse section of either the hepatic or common duct. The common and hepatic ducts are explored and any calculi are removed as usual. Traction on the lips of the cystic duct with forceps facilitates catheterization and brings the ducts before the surgeon who incises them one by one.

A Kehr T drain or two drains, one in the hepatic the other in the common duct, establishes drainage of the hepatic duct. The drain is fixed with a small catgut No. 00 suture to the walls at the junction of the two ducts (Fig. 1).

The gall bladder is now quickly removed by retrograde manipulation after the cystic duct is ligated. The cystic artery is cut and carefully ligated (Fig. 2).

Variant. When the liquid withdrawn from the gall bladder appears to be virulent and very septic it is well to section the cystic duct between two ligatures and to perform the cholecystectomy before approaching the junction and the common duct step by step through the cystic duct.

Third stage—making the serohepatic tunnel. Suture of the wall.

The Kehr drain or the two drains from the hepatic and the common ducts are kept buried in

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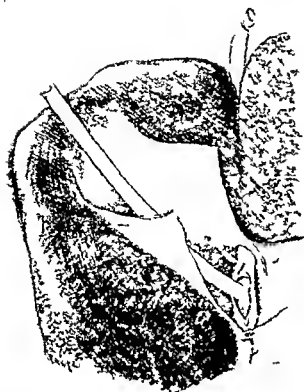


FIG. 3. Drainage of the hepatic with a T drain. Suture of the peritoneal flaps over the drain forming a serohepatic tunnel.

the cystic fossa. A fine catgut suture brings the two peritoneal flaps together in the midline to form a serohepatic tunnel which has an exit at the surface (Fig. 3). This suture begins in the deep tissues at the junction of the ducts and carefully closes the end of the handle of the racket of the primary peritoneal incision beneath the drains. A small needle is used and the suture points are made close together so as to assure the absolute tightness of the serous tunnel. If the peritoneal flaps are loose a second reinforcing suture may be supplemented.

The suture is finished at the bottom of the tunnel. Three suspension sutures preferably U shaped are passed to the angles of the bottom of the tunnel. They are not tied but their free ends are caught in forceps which are handed to an assistant. The surgeon locates the point on the incision in the wall at which it is easiest to fix the serohepatic tunnel and at the same time to cause as little traction as possible and to prevent the bending of the drain. It only remains now to close the abdominal incision and to fix the serous tunnel to the parietal peritoneum at the point chosen. The incision in the wall is carefully sutured except for the opening in the peritoneum which is the size of a two franc piece and is left opposite the bottom of the tunnel. The tunnel is

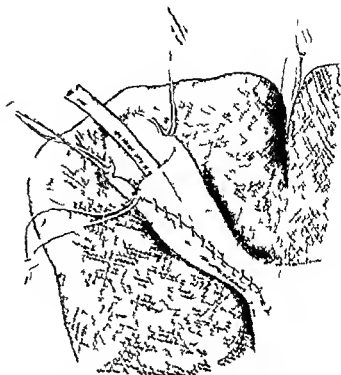


FIG. 4. The suture bringing the lips of the gall bladder peritoneum together forms a continuous serous tunnel from the common duct to the wall.

kept outside the parietal peritoneum by the three suspension sutures mentioned.

A curved Reverdin needle carrying the two ends successively of each of the U suspension sutures is passed through the parietal peritoneum, the transversalis fascia and the aponeurosis (deep layer of the muscle sheath). The sutures are lightly tied thus assuring as perfect application as possible of the serous tunnel to the parietal peritoneum (Fig. 5).

The skin is sutured with horsehair. Some gauze compresses are placed on the incision in the wall and fixed with leucoplast which covers them completely so as to form a water tight dressing for 48 hours during which time a large ice bag is kept on the abdomen. With a horsehair suture or with a band of leucoplast the drain or drains are fixed to the skin at a distance.

RESULTS

The postoperative course is very simple when the conditions are carefully studied during the operation and the proper procedure is determined. The drain is removed between the fifteenth and eighteenth days depending on the temperature curve and the character of the bile which is watched every day. Generally by the twenty-fifth day cicatrization is complete and the wall is solidly healed. Only for the first 36 hours does the patient have pain which is located at the site



Fig 5 The bottom of the incision is closed to the parietal peritoneum by a suture passing over the drainage tube. The bottom of the incision is closed to the parietal peritoneum by a suture passing over the drainage tube.

of fixation of the bed of the gall bladder to the wall. The pain is easily controlled by ice and the use of narcotics but narcotics should be limited to patients with liver affections. There is not the prolonged pain from peritoneal reaction so often present when the subhepatic tampon is used also the dreadful trial of removing the tampon which is always very painful is avoided. The patient is also protected from the complications—secondary hæmorrhage postoperative evisceration intestinal fistula diffuse peritonitis—which complications are always possible when the tampon has been removed.

There are no late complications no postoperative eventration as the wall has been carefully reconstructed and also no postoperative subhepatic adhesions as the whole field of operation has been covered with a continuous serous covering.

CONCLUSIONS

This operation which gives the maximum of both operative safety and simplicity of the postoperative course cannot unfortunately always be performed and it may be dangerous. According to our personal experience it should be performed only in about half the cases.

It cannot be performed (a) when the gall bladder is very much degenerated as then it would be impossible to cut peritoneal flaps that are large enough (b) when the detachment of the peritoneum does not furnish continuous flaps. It is dangerous and should not be performed (a) when suppurations around the gall bladder have been opened in the process of freeing the gall bladder and (b) when the general condition of the patient is so serious that the operation must be performed as quickly as possible.

The advantages are that it is possible to remove the drain from the common duct early while keeping the drain in the hepatic duct and to collect the bile which comes from the hepatic duct in a sterilized vessel to be reinserted after sterilization in the intestine through the drain in the common duct. This is a very effective means of combating the rapid emaciation and asthenia following too great a loss of bile after operation.

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FROM THE SURGICAL CLINIC MEXICAN NATIONAL SCHOOL OF MEDICINE

TREATMENT OF INCISIONS BY THE OPEN METHOD

DR ULISES VALDES FACS MEXICO CITY MEXICO

OCCASIONALLY it is a good thing to turn aside from the major surgical problems to think a little about some steps in operations which though they are of relatively little importance are worthy of study in order to attain the maximum of surgical perfection. Little thought is given to the technique of the last step in a surgical operation—the suture of the skin. Every surgeon has his own routine method and he does the closure mechanically if he does not turn it over to an assistant. At times poor skin suture causes the surgeon some trouble necessitates a prolonged stay of the patient in the hospital and leaves him with a large ugly permanent sometimes painful scar.

This led me to read with great care the method described by Drs George W Roberts and Kingsley Roberts of New York in the *Annals of Surgery* for June 1927. After a classification of surgical wounds according to their evolution to which I will return later they take up the new point in their article when the suture of the skin is finished in the manner to be described a current of hot air is passed over it to dry it then a sterile compress is placed over it while the patient is being carried to his bed here the wound is exposed to the air until it is completely dry and then merely covered by the patient's clothes with no other preparation whatsoever. For the next few days the healing of the wound is simply watched and no medication is used unless some accident occurs. The method deserves its name

and is a distinct break from the old custom of covering a wound with gauze and cotton.

What conditions are necessary to bring about healing of a wound by first intention?

First the skin should be properly disinfected second the steps of the operation should be done under aseptic conditions or at least care should be exercised not to contaminate the lips of the wound and finally the skin should be correctly sutured that is to say not only under the most rigid asepsis but hæmostasis must be complete and the skin edges accurately coapted. If all these conditions are fulfilled it is necessary that the wound be covered only with a thick layer of aseptic gauze or that it be left in contact with the patient's clothes. A thin membrane forms over the suture line of the skin surfaces which protects the process of cicatrization and completely isolates the wound from the external air. This is the fundamental principle of the method and the reason for its success.

The technique which we use to bring about proper cicatrization is briefly as follows.

Except in emergency cases the skin of the patient is sterilized the evening before the operation by washing it with water and sterile soap and shaving the parts where shaving is necessary. The skin is rubbed with 96 per cent alcohol then with a 0.5 to 1.000 mercury iodide solution and last with Harrington's solution. The skin is dried with cotton and covered with compresses of sterile gauze held in place with a bandage. This dressing is



Fig 1 Suture carrying needle at either end

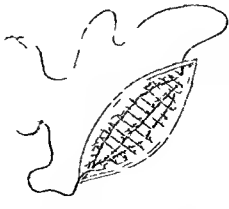


Fig 2 Medium sized needle laid aside temporarily

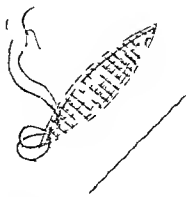


Fig 3 The wound shows slightly wavy line

| POSTOPERATIVE COURSE OF INCISIONS | | | | | | | | | | | | | | |
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| N m | | | | | S by | F | W | d | m Th | | | | | |
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| W | h | y | d | f | te | h | | | | | | | | |
| W | h | y | caso | f | h | k | 1 heal | g | by fir 1 | | | | | |
| | da | | | | 6 h | lay | h d | | | | | | | |
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| | h d | | | | h | day | 5th day | | | | | | | |
| Att | | | | P p | S | serum | S | bl | f G g | | | | | |
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| Cla | fic | | | | | | | | | | | | | |

I 4 Rec d heet used t\ ldes S t n m

taken off the next day and when the patient is on the table the field is painted with tincture of iodine shortly before operation is started.

A layer of sterilized rubber is placed over the skin which is incised as if it were the first layer and when the skin has been sectioned the sterilized rubber is fixed to it by clamps thus protecting the skin from all septic contact.

The technique for the superficial layers is as described by Dr Ignacio Franco interne of the hospital in a preliminary communication made to the Eighth National Medical Congress.

When the deep layers have been closed to the superficial aponeurosis the subcutaneous cellular tissue and the skin are sutured in the following manner with a suture of twice the usual length threaded into a fine needle at one end and into a medium sized one at the other the suture is begun by passing the thread into the fatty cellular tissue at one of the angles of the wound and tying it in the middle so as to leave two threads of approximately the same length with a needle at each end (Fig 1).

With the medium sized needle a Cushing suture is run to the opposite end of the wound and this thread and needle are then laid aside temporarily (Fig 2). When the Cushing suture is finished the fine needle is taken up and after one or two

stitches backward in the cellular tissue which make it possible to begin an intradermal suture at the end of the wound this suture is continued with the same technique as the other one to the opposite end of the wound. The two sutures the one in the fatty cellular tissue and the intradermal one pass beneath the two last stitches of the intradermal one (Fig 3) are pulled together to bring about perfect coaptation and the superficial and deep threads are tied with the ends very short so they may be hidden beneath the skin suture. The wound shows a slightly wavy line.

The postoperative care is the same as that used by the authors before mentioned when the suture is finished and the wound is washed with sterile water a current of hot air is passed over it for some minutes then the region is covered with a sterile compress and the patient is put to bed after which hot air is passed over the wound again and it is left in contact with the bed clothes which are not prepared in any way.

In large abdominal wounds some strips of adhesive plaster are applied perpendicular to the wound as a support when distention is feared.

A special record sheet shown in Figure 4 is kept and the wounds are classified in four groups.

Group A Wounds which during cicatrization have not discharged blood serum gas or pus except perhaps a slight exudation of blood or serum in the first few hours after operation.

Group B Wounds which within the first 72 hours have discharged a small amount of blood serum or gas or a small non infected clot.

Group C Wounds which within the first 10 days discharge pus without interfering with the patient's convalescence.

Group D Wounds in which some complication affects the patient's convalescence such as extensive infection or spontaneous rupture.

We have selected a group of 110 wounds in which no canalization or other process affected normal cicatrization. The results were as follows: Group A 93.78 per cent Group B 20.16 per cent Group C 6.5 per cent Group D 0.

Taking into consideration the fact that Group B are wounds in which there is only a slight discharge of blood or serum which did not disturb cicatrization and that on leaving the hospital except for a slight disturbance in healing they were completely cicatrized like those in Group A we have a total in Groups A and B of 113 successful results in 119 cases or 94 per cent.

These excellent results have led us to describe this method for the benefit of others.

THE TREATMENT OF MAMMARY CARCINOMA BY MEANS OF REMOVABLE RADIUM NEEDLES¹

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THE purpose of this communication is to describe an improved method of interstitial radiation which has yielded satisfactory primary regressions in types of inoperable breast carcinomata that have failed to respond to other radiotherapeutic methods. It is not within the scope of this paper to discuss in detail the various stages through which the radiation treatment of mammary carcinoma have passed. The marked limitations of external radiation—X rays and radium—in the treatment of mammary carcinoma are now fully recognized. Neither will it be attempted to discuss the relative merits of surgery and radiation in the treatment of operable mammary carcinoma since the evidence today does not yet permit a decision on this important question. The text of this communication will deal primarily with the treatment of *inoperable* carcinoma of the breast by interstitial radiation.

DIFFICULTIES IN THE RADIATION TREATMENT OF MAMMARY CARCINOMA

Several important difficulties are encountered in the radiation treatment of mammary carcinoma.

1 The presence of carcinoma in areas of the breast that are apparently normal on clinical examination render it imperative to regard the entire organ as invaded by carcinoma when treatment is planned.

2 The presence of disease in the areas of lymphatic drainage when no disease can be detected clinically renders it necessary to assume

that these areas too are invaded even when no evidence of disease can be made out by clinical examination. The same underlying principle that ordains the radical operation for a small and apparently localized mammary carcinoma necessitates radical irradiation of the entire field if the latter method is to be employed successfully with these considerations it is necessary to irradiate the entire breast, the axillary contents and supraclavicular space without consideration of the size of the primary tumor or the extent of the disease. Thus the problem resolves itself into that of delivering to this wide field a uniform homogeneous and adequate dose of radiation if a complete and certain sterilization of this potentially invaded field is to be expected.

3 Were mammary carcinoma sufficiently radiosensitive to permit of the delivery of a lethal dose to the tumor cells by means of external radiation alone the radiation treatment of mammary carcinoma would be greatly simplified. In small thin breasts an actual sterilization of the tumor by intense external radiation with radium has been accomplished in a small group of cases. When the breast is large and fat the geometrical conditions are more unfavorable and the delivery of an intense and uniform dose of radiation by surface application is considerably more difficult.

4 The anatomical relations of the axillary lymphatic glands render it almost impossible to deliver an adequate and uniform dose of radiation to these structures without injuring the skin and

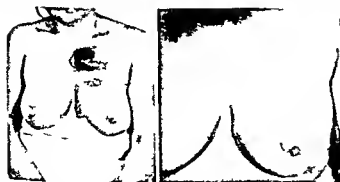


Fig 1 left Extensive carcinoma of breast with impending ulceration before treatment (Case 1)
Fig 2 Complete disappearance of lesion seen in Figure (Case 1) following interstitial rad at on

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Fig 3 left Extensive ulcerated carcinoma of breast before treatment (Ca e 2)
Fig 4 Complete disappearance of tumor and healing of ulceration (Ca e 2) after interstitial radiation



Fig 5 X-ray of breast showing glandular tissue and radiolucency

the important axillary vessels and nerves. The difficulty of efficiently irradiating the axillary lymphatic glands constitutes the most important barrier to the successful treatment of carcinoma by means of radiation.

THE RADIOSENSITIVITY OF MAMMARY CARCINOMA

Carcinomata of the breast exhibit notable variations in radiosensitivity. On the whole it may be said that carcinoma of the breast is moderately resistant to treatment with X-rays and radium. Compared with other glandular carcinomata their radiosensitivity is approximately the same as that of carcinomata of the rectum, stomach and body of the uterus. If a large series of carcinomata of the breast be treated with maximum doses of X-rays or radium applied externally three degrees of response can be observed. A small proportion of the tumors respond so slightly that the change is hardly perceptible by clinical examination. The largest proportion exhibit a moderate diminution in size and a very small proportion show a marked and sometimes rapid response to external radiation. The rapid and complete disappearance of a mammary carcinoma after external radiation is sometimes observed but is a very rare occurrence. These variations in radiosensitivity of mammary car-

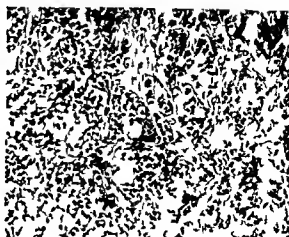


Fig 6 Photomicrograph of breast tissue showing cellular structure (Fig 3). The true structure is highlighted.

cinoma are not unusual. Similar variations are noted in carcinomata affecting other organs.

INTERSTITIAL RADIATION IN THE TREATMENT OF MAMMARY CARCINOMA

Because of the limitations in the effect of external radiation on mammary cancer it becomes necessary in most instances to resort to interstitial radiation in order to deliver a lethal dose to the tumor cells. Interstitial radiation is most efficacious in small accessible tumors. It is not difficult for example to distribute radium needles around a mammary carcinoma with sufficient accuracy to insure its complete sterilization when the tumor is small and the radiation correctly applied. The uniform distribution of radium needles throughout an entire breast—considering all its dimensions—is almost impossible. The most important obstacle in the way of the successful treatment of mammary carcinoma by radiation is the problem of delivering to the axilla an adequate uniform and homogeneous radiation.

From examination of mammary carcinomata that have been removed following interstitial radiation it is at once obvious that the most important cause of failure is the inaccurate distribution of the radium foci. It is important to realize that unless the distribution of the radium foci is uniform the method is doomed to failure. Theoretically the distribution of radium foci must reach almost geometric perfection—a goal that is impossible to reach under the given conditions. In specimens of mammary carcinoma that have been treated by interstitial radiation (gold radon seeds) in which the distribution has been faulty, I have found scattered foci of viable tumor cells.

lying among areas of completely necrotic tumor tissue. In isolated examples in which the distribution has been uniform the destruction of the primary tumor has been so complete that degenerated remnants of several tumor cells were found only after careful search by numerous sections and these have constituted the only available evidence of preexisting carcinoma.

It is an interesting fact that minute foci of tumor cells that have not been devitalized by radiation can flourish in an avascular tissue medium consisting of necrotic debris. Histological examination of irradiated tumors often shows groups of well staining hyperchromatic cells growing in dense, hyaline avascular connective tissue a condition to which Ewing has applied the term 'abortive fibrosis'. The importance of these observations is that it is these foci that constitute the elements of recurrence and determine the failures in radiation therapy. They also emphasize the necessity of a uniform radiation. The fundamental question that arises in the treatment of mammary carcinoma by interstitial radiation alone is this: Is it technically possible to distribute a large number of radium needles throughout a carcinomatous breast and axilla with sufficient uniformity and accuracy completely to devitalize and sterilize all the tumor cells and thereby accomplish a cure of the disease in these situations?

One of the earliest attempts to treat mammary cancer by interstitial radiation was carried out in the Memorial Hospital by Drs. Lee (3) and Adair. Long platinum radon needles were inserted through the mammary growth and removed after several hours. Some favorable results were obtained by this method particularly in tumors of small dimensions. The most important objection to this method is that only the palpable tumor was irradiated and recurrences frequently appeared in outlying parts of the breast which appeared clinically normal but were actually invaded by carcinoma. This method was first supplanted by external radiation and more recently by interstitial radiation with gold radon implants. Interstitial radiation of mammary carcinoma with removable platinum needles was also employed by Kaplan¹ in the Bellevue Hospital as early as 1924. An important investigation of the effect of gold radon implants on mammary carcinoma has been conducted recently by Pack² on the service of Dr. Lee at the Memorial Hospital. His extensive histological studies of irradiated breast tumors have yielded

valuable information concerning the dose of radiation necessary to devitalize a given unit of tumor tissue.

KEYNES'S METHOD OF INTERSTITIAL RADIATION

The most comprehensive and systematic attempt to treat mammary carcinoma by interstitial radiation was begun by Keynes in 1924 and the results were reported in 1928 and 1930. The underlying principles of Keynes's method consist in distributing a number of radium bearing needles containing small amounts of radium (2 and 3 milligrams of radium element) underneath and around the breast tumor and accessible areas of lymphatic drainage. The total amount of radium necessary in the adequate treatment of a mammary carcinoma varies with the size of the tumor between 60 and 90 milligrams. The radium in the form of radium sulphate is contained in platinum needles each containing 3 milligrams distributed along an active length of 4.8 centimeters. For the supraclavicular and infraclavicular regions and the intercostal spaces a few shorter needles containing 2 milligrams of radium element with an active length of 3.2 centimeters are needed. The filtration is 0.5 millimeter platinum.

The radium needles are inserted so that the carcinoma and a considerable area surrounding it are illuminated by the radiations. Needles are also inserted into the axilla beneath the pectoralis major above the clavicle below the clavicle and over the first three or four intercostal spaces. The needles are allowed to remain in position for at least 1 week and sometimes for as long as 10 days if the tumor is a large one. They are then removed under gas and oxygen anaesthesia.

An essentially similar method of radiation of mammary carcinoma is employed by Cade with the exception that the interstitial radiation is followed 1 month later by surface radiation. The latter procedure is accomplished by means of a Columbia paste cast which covers the anterior posterior and lateral aspects of the chest and supraclavicular areas. Irradiation is continued for 14 days the average dose being 35,000 milligram hours in equal halves for each aspect of the thorax. This phase of the treatment aims at the sterilization of the tumor cells which have been unaffected by the needling.

CHEATLE'S METHOD OF INTERSTITIAL RADIATION

Cheatle's pathological investigations have impressed him with the importance of exposing the whole breast to radiation and not only that part

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of it containing the palpable lump. The axillary supraclavicular and intercostal regions are radiated in every case however localized to the breast the disease appears to be.

Cheatle employs the following technique. 80 milligrams of radium element are distributed in 29 needles varying in length as follows:

| N | di | A | l | gth | E | h | ta | g |
|---|----|---|---|-----|---|----|----|---|
| | | | t | m | m | gr | m | |
| 3 | | | 8 | 3 | | | 5 | |
| 6 | | | 7 | | | | 4 | |
| 7 | | | 6 | | | | 3 | |
| 7 | | | 4 | | | | 2 | |
| 6 | | | 3 | | | | | |

The ultimate position of the three longest needles is first fixed by inserting them as the central needles of the bottom layer. These needles are placed in position by means of a trocar and cannula. All the needles in the bottom layer are inserted parallel to each other in the posterior part of the breast and irradiate the submammary connective tissue and the upper fibers of the pectoralis major muscle. In the next layer the needles are arranged parallel to each other at right angles to the bottom layer. Whether three layers of needles are inserted depends upon the size of the breast. Lastly the three long needles are passed into the three cannulas which are then withdrawn leaving the needles in position.

In order to help him gauge the number of needles and the position they should occupy, Cheatle adopts the following method. The circumference of the breast is measured and marked on a clay surface. Twenty nine cylindrical blocks of wood each corresponding in length and circumference to the area of radiation of each of the needles are used. The size of these blocks of wood represents an area of 1 centimeter in all directions. By arranging these blocks of wood the number of needles, their position and their distances from one another can be estimated with considerable accuracy.

AUTHOR'S TECHNIQUE

In the attempt to distribute radium bearing needles uniformly throughout a tumor mass the type of needle best suited for this purpose comes up for consideration. It is at once obvious that the longer the needle the more accurate is the distribution of the radiation. The use of long needles has the distinct advantage that the fewer needles that are used the less chance there is of uneven distribution. The advantages of long needles over seeds are quite obvious.

In view of the radioresistance of most mammary carcinomata the total quantity of radiation is a significant element in the result. Any factors

therefore that permit the delivery of a larger dose of radiation to the tumor are important. The three factors that come up for consideration are (1) filtration, (2) the choice of radium element or radon, and (3) the total quantity of radium in relation to the time of exposure.

There is sufficient proof at hand to justify the belief that adequate filtration (0.5 millimeter platinum or its equivalent) is desirable in the treatment of all tumors. It is also very probable that the tumor bed can withstand a larger quantity of adequately than lightly filtered radium. There is reason to believe that with adequate filtration the integrity of the normal breast tissue surrounding the tumor can be better maintained and consequently a larger total dose of gamma radiation may be delivered to the tumor without injury to the tumor bed.

The action of radium element is uniform where as radon possesses a maximum intensity in the beginning which gradually diminishes with the time of exposure. The intensity of the initial dose is one limiting factor in the total amount of radon that a given tissue can tolerate. The uniform action of radium element has certain advantages in this respect over the uneven action of radon. Whether the difference is of sufficient practical importance to justify the exclusive use of radium element is at present uncertain.

Regaud has claimed that prolonged irradiation over a period of 6 to 8 days has a more marked destructive effect upon a tumor than a similar total dose delivered over a shorter period of time. Aside from this factor there is considerable evidence to indicate that the toleration of normal tissues is greater when small doses are used over long periods than when a single intensive dose is delivered over a period of several hours. It is logical to believe that in the attempt to deliver a maximum total dose of radiation to a carcinoma in the breast a larger total dose can be safely delivered when prolonged over 6 to 9 days than can be delivered in a short period of several hours. It would seem therefore that the most efficient technique of radiation can be executed by the use of long needles carrying small amounts of radium or radon distributed as uniformly as possible throughout the tumor bearing area and allowed to remain in place for a period of days (6 to 9 days). The author has designed needles for interstitial irradiation as follows:

The needles are constructed in three lengths, 9, 6 and 3.5 centimeters. A gold cylinder with a lumen just large enough to hold glass capillary

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tubes is encased in a stainless steel jacket. The filtration is equivalent to 0.5 millimeter of platinum. The glass capillaries containing radon are held in place by means of paraffin.

The needles are inserted through the mammary gland and into the lymphatic areas. To the radium needles are attached thin steel wires by which they can be safely withdrawn after having remained in the breast from 7 to 9 days. In placing the needles the main mass of the tumor is avoided, the periphery of the growth being the main objective of the radiation. This technique lessens the danger of dissemination of tumor cells by trauma and prevents the over radiation of the center of the tumor. The principle of irradiating the periphery of the tumor rather than its center is an important technical consideration that has not been sufficiently emphasized. The center of the growth has a tendency to spontaneous regression and necrosis. Intensive radiation of such an area often results in a complete destruction with central necrosis of tissue. The periphery of the growth is more active and is the zone upon which the radiation must be concentrated. By means of highly filtered uniformly distributed accurately applied and adequate interstitial radiation it is possible to obtain primary regression and disappearance of mammary tumors which fail to respond to a maximum amount of external radiation.

The technique employed by the writer is based upon the principles of Keynes's method. Radon has been used instead of the radium element. The needles have been made longer in order to insure a more uniform radiation. In the plan of treatment the entire breast is regarded as potentially malignant and the whole gland is irradiated regardless of the size of the tumor mass. The patient receives 1/200 grain scopolamine and 1/6 grain morphine hypodermically 1 hour before operation and a second injection is given when the patient enters the operating room. One per cent novocain is used as a local anesthetic. The needles are introduced through puncture wounds in the skin previously made with a sharp pointed scalpel. The needles are allowed to remain for 6 to 9 days depending upon the size of the mass. The millicurie value of each needle is approximately 1 millicurie per centimeter length of needle. The total millicurie value employed at one sitting varies between 100 and 130 millicuries. A biopsy of the tumor is performed only in ulcerated lesions or when the clinical diagnosis is in doubt in non ulcerated lesions. The number of needles employed depends upon the size of the tumor and size of the breast. The needles are

placed approximately 1 centimeter apart. Only the periphery of the tumor is irradiated, no needles actually entering the main mass.

REPORT OF CASES

CASE 1. P. W. female aged 47 years was admitted to the New York City Cancer Institute on January 30, 1930. The patient had noted a mass on the left anterior chest wall for 2 years. The mass was gradually becoming larger and the overlying skin had recently become thinned and discolored. Examination showed a firm irregular mass 6 by 9 centimeters at the base and 4 centimeters high situated at the edge of the upper inner quadrant of the left breast and firmly attached to the chest wall. The overlying skin was markedly thinned shiny and purplish red in color. There was impending ulceration. The axillary lymphatic glands and supraclavicular glands were not enlarged.

Treatment. On February 18, 1930, 30 radon bearing needles each 3.7 centimeters in length and each containing 3.5 millicuries of radon were inserted into the periphery of the growth (see Figs. 1 and 5). The needles were removed after 6 days. The total dose delivered to the tumor was 9150.4 millicurie hours. Regression began immediately and was almost complete after 3 weeks. Two small discrete tumor nodules at the inner lower quadrant measuring 3 centimeters each remained. In view of the total sterilization of the remainder of the tumor mass it is believed that these nodules failed to disappear because the needles at that site had lost their radon content during their preparation. On March 25, 1930, 11 needles were inserted beneath the remaining nodules for 6 days. The total millicurie value was 34.36 millicuries. The total dose was 4507 millicurie hours. The second irradiation was followed by a marked but less pronounced response than occurred after the first irradiation. On June 3, 1930, a third irradiation was performed, 11 short needles each 2.7 centimeters in length being used. Total value 29.8 millicuries for 6 days giving a total dose of 6260 millicurie hours. The total dose delivered to this tumor during the three treatments was 16277 millicurie hours. As the axillary and supraclavicular lymphatic areas showed no clinical evidence of disease they were treated with external applications of radium.

The remarkable feature about this case is the perfect recovery of the superjacent skin which appeared to be condemned and the prevention of an impending ulceration. The irradiation of the tumor mass caused a shrinkage and disappearance of the tumor and a collapse of the overlying skin which promptly recovered its normal texture. To avoid ulceration and possible infection no biopsy was made but the clinical diagnosis is obvious (Fig. 1).

CASE 2. B. C. female aged 74 years was admitted to the New York City Cancer Institute on February 17, 1930. The patient first noted a lump in the left breast 3 years before admission. The lump increased in size and became ulcerated 3 weeks previously.

Examination showed an ulcerated lesion 3 centimeters in diameter situated above the left nipple under which there was a firm nodular mass 8 centimeters in diameter movable on the chest wall. There was one enlarged axillary node 2 centimeters in diameter, no nodes were felt in the supraclavicular area.

of it containing the palpable lump. The axillary supraclavicular and intercostal regions are radiated in every case however localized to the breast the disease appears to be.

Cheate employs the following technique. 80 milligrams of radium element are distributed in 29 needles varying in length as follows:

| N. of | Length in cm. | Radium element in milligrams |
|-------|---------------|------------------------------|
| 3 | 8 1/2 | 5 |
| 6 | 7 | 4 |
| 7 | 6 | 3 |
| 7 | 4 | 2 |
| 6 | 3 | |

The ultimate position of the three longest needles is first fixed by inserting them as the central needles of the bottom layer. These needles are placed in position by means of a trocar and cannula. All the needles in the bottom layer are inserted parallel to each other in the posterior part of the breast and irradiate the submammary connective tissue and the upper fibers of the pectoralis major muscle. In the next layer the needles are arranged parallel to each other at right angles to the bottom layer. Whether three layers of needles are inserted depends upon the size of the breast. Lastly the three long needles are passed into the three cannulas which are then withdrawn leaving the needles in position.

In order to help him gauge the number of needles and the position they should occupy Cheate adopts the following method. The circumference of the breast is measured and marked on a clay surface. Twenty nine cylindrical blocks of wood each corresponding in length and circumference to the area of radiation of each of the needles are used. The size of these blocks of wood represents an area of 1 centimeter in all directions. By arranging these blocks of wood the number of needles their position and their distances from one another can be estimated with considerable accuracy.

AUTHOR'S TECHNIQUE

In the attempt to distribute radium bearing needles uniformly throughout a tumor mass the type of needle best suited for this purpose comes up for consideration. It is at once obvious that the longer the needle the more accurate is the distribution of the radiation. The use of long needles has the distinct advantage that the fewer needles that are used the less chance there is of uneven distribution. The advantages of long needles over seed are quite obvious.

In view of the radioresistance of most mammary carcinomata the total quantity of radiation is a significant element in the result. Any factors

therefore that permit the delivery of a larger dose of radiation to the tumor are important. The three factors that come up for consideration are (1) filtration (2) the choice of radium element or radon and (3) the total quantity of radium in relation to the time of exposure.

There is sufficient proof at hand to justify the belief that adequate filtration (0.5 millimeter platinum or its equivalent) is desirable in the treatment of all tumors. It is also very probable that the tumor bed can withstand a larger quantity of adequately than lightly filtered radium. There is reason to believe that with adequate filtration the integrity of the normal breast tissue surrounding the tumor can be better maintained and consequently a larger total dose of gamma radiation may be delivered to the tumor without injury to the tumor bed.

The action of radium element is uniform where as radon possesses a maximum intensity in the beginning which gradually diminishes with the time of exposure. The intensity of the initial dose is one limiting factor in the total amount of radon that a given tissue can tolerate. The uniform action of radium element has certain advantages in this respect over the uneven action of radon. Whether the difference is of sufficient practical importance to justify the exclusive use of radium element is at present uncertain.

Regaud has claimed that prolonged irradiation over a period of 6 to 8 days has a more marked destructive effect upon a tumor than a similar total dose delivered over a shorter period of time. Aside from this factor there is considerable evidence to indicate that the toleration of normal tissues is greater when small doses are used over long periods than when a single intensive dose is delivered over a period of several hours. It is logical to believe that in the attempt to deliver a maximum total dose of radiation to a carcinoma in the breast a larger total dose can be safely delivered when prolonged over 6 to 9 days than can be delivered in a short period of several hours. It would seem therefore that the most efficient technique of radiation can be executed by the use of long needles carrying small amounts of radium or radon distributed as uniformly as possible throughout the tumor bearing area and allowed to remain in place for a period of days (6 to 9 days). The author has designed needles for interstitial irradiation as follows:

The needles are constructed in three lengths 9.6 and 3.5 centimeters. A gold cylinder with a lumen just large enough to hold glass capillary

Th h d D C F U f h aid d gn d
tr mg h d bled dl sed th t tm f h se se

MALIGNANT TUMORS OF THE KIDNEY IN CHILDHOOD¹

A REPORT OF SEVEN CASES OF EMBRYONAL ADENOSARCOMA

FREDERICK LIEBERTHAL M.D. CHICAGO

MALIGNANT tumors of the kidney in childhood occupy a special place in renal pathology. They differ from malignant tumors of that organ in the adult in their mode of origin in their structure and in their course and clinical picture. It is now generally conceded that most of these new growths arise from misplaced embryonal rests and different as they may appear in their gross and histological structure are mixed tumors having the same origin.

Cohnheim in 1875 first reported a congenital sarcoma of the kidney which contained striated muscle. He assumed that it had developed from a misplaced mesonephric rest to which a segment of the myotom which furnished the striated muscle had become adherent. Weigert in the next year reported a congenital adenocarcinoma of the kidney which he believed to have originated from the epithelial renal anlage. Subsequently numerous reports appeared in the literature of various types of malignant renal tumors in childhood. Some of these were merely designated loosely as sarcoma or carcinoma while many others were recognized as mixed tumors which differed from one another markedly in their gross and histological structure. They contained epithelium indifferent round cells smooth muscle collagenic and elastic connective tissue and cartilage in varying amounts.

But in 1896 Birch Hirschfeld on the basis of a study of seven specimens and a critical survey of the literature first discovered the common origin of these neoplasms and placed them in one group. He recognized as the typical new growth of this class the adenosarcoma the characteristic feature of which is epithelial acini occurring in nests of indifferent round cell tissue. He believed the point of origin to be in misplaced rests of the mesonephros and he called them embryonal glandular tumors (*embryonale Druesengeschwuelste*) or embryonal adenosarcomas.

Because striated muscle is a frequent constituent of these tumors Wilms placed their point of origin at a much earlier embryonic stage of development. Smooth muscle does occur in the mesonephros and rests of it are often found in the adult kidney. But unless one assumed a metaplasia of smooth muscle to striated which Wilms believed could not occur it would be impossible to

explain the development of a striated muscle containing tumor from the mesonephros which contains no striated muscle elements. Hence Wilms believed the origin to be from an early mesodermal rest which has the power of differentiating into sclerotom myotom and nephrotom. Then the myotom would give rise to the striated muscle the nephrotom to the glandular complexes and the sclerotom to the other elements of the tumor.

Ribbert however believed that a metaplasia from smooth to striated muscle could occur. He reported a case of myosarcoma striocellulare of the pelvis and ureter in which he assumed the striated muscle to have arisen by metaplasia from the smooth muscle of the ureter and the pelvis. In support of this view he demonstrated the presence of transitional muscle forms. Tubulo epithelial elements were also present and these he thought arose from the pelvic epithelium of the kidney.

Busse likewise believed in the possibility of such a metaplasia and he cited as proof the presence of transitional forms the arrangement not in bundles but in scattered cells and the occurrence of striated muscle in other places where only smooth muscle is normally present. As examples of the latter he mentioned tumors of the cervix and vaginal wall in children and in the uterus following pregnancy. He thought that the embryonal adenosarcomata did not arise from misplaced mesonephric rests because resting non proliferating islands of the mesonephros have never been found in the kidney. In the case of hypernephromata we have a different situation. Adrenal rests are frequently found in the kidney and hence the suggestion that tumors might develop from them as they do from the adrenal gland itself is justifiable. Busse made sections from the kidneys (metanephros) of 4 and 5 month human embryos and found that the metanephric renal epithelium with its surrounding round cell tissue exactly resembled the tubulo epithelial complexes in indifferent round cell tissue in the embryonal adenosarcomata. He believed therefore that these tumors arose from the metanephros the epithelial complexes from the metanephric epithelium and the other constituents from the interstitial tissue either directly or by metaplasia.

¹ From the First Institute of Pathology of the Royal Hungarian Academy of Sciences, Budapest. Received for publication, July 1, 1910. Reprinted from the *Journal of the American Medical Association*, Chicago, Ill., Vol. 4, No. 1, p. 1, 1910.

Totals: Two to five don needles each 37 cc to met's length and each containing approximately 35 milluries of radon were inserted in the tumor mass for 7 days. The total milluries destroyed were 778 milluries. On May 8, 1933, the left axillary node was treated by surface application of radon to the metastatic deposit. The dose was 300 milluries. On May 22, 1933, a second radium application was made to the same nodes. 500 milluries. On May 26, 1933, the best tumor had disappeared almost completely. The thickened area with a small superficial lesion in the lun which was slow to heal. This sign was taken as a definite sign of cure and a second radium implantation was performed. For the next 24 hours needles were inserted into the area giving a dose of 600 milluries. The nodes and for 12 days needles were inserted into the left axillary node. 832 milluries. On June 4, 1933, the phyllopharyngeal area was treated with radon. The dose was 100 milluries. On June 13, 1933, the phyllopharyngeal area was treated with radon. The dose was 100 milluries. On June 13, 1933, the phyllopharyngeal area was treated with radon. The dose was 100 milluries.

As Figure 4 indicates, there has been complete healing of the ulcerated area and the disappearance of the metastasis. The axilla and subclavicular areas are clinically free of disease. Figure 6 is a photomicrograph of a biopsy specimen taken from the ulcerated site of the lesion.

SUMMARY AND CONCLUSIONS

1. Because of the radioresistance of mammary carcinoma, interstitial radiation constitutes the method of choice in the treatment of inoperable carcinoma of the breast.

2. Long radium needles that are removable permit a more uniform radiation than can be accomplished by radon seeds.

3. Adequate filtration (0.5 millimeter platinum) is essential in order to effect complete regression of tumors without necrosis.

4. The irradiation of mammary carcinoma must follow the same principle as the radical operation for this disease, i.e., the entire mammary gland and lymphatic areas must be regarded as invaded regardless of the extent of the disease as previously determined by clinical examination.

5. The peripheral or growing edge of a tumor is the most dangerous part of the lesion and requires the most intense radiation. The central portion is poorly nourished, tends to bring about spontaneous necrosis and requires relatively little radiation.

6. Healing of ulcerated lesions of the breast can be accomplished and impending ulceration prevented by the technique of radiation that has been presented. No claim can be made, however, for the permanency of the results.

7. Peripheral radiation by means of long removable radon needles can accomplish regression of advanced mammary carcinomata which fail to respond to other methods of radiation therapy.

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the lungs. The osseous system and the lymph nodes are usually spared. Neoplasms of the kidney in general, because of the structure and the rich vascular supply of that organ are especially prone to metastasize by way of the blood stream.

Occasionally the embryonal adenosarcoma spread to the surrounding organs by way of the lymph channels. But this occurs usually only after the tumor has attained a very large size and has broken through its capsule. At that stage local infiltration of the surrounding tissues and adhesions may also occur. The metastases may either resemble the original tumor or only one or more of its constituents may be present as in other mixed tumors. They usually occur late.

OCCURRENCE OF THE ATYPICAL FORMS

Malignant renal tumors in children are often carelessly described as rhabdomyoma, sarcoma, carcinoma, myoma, etc. As a matter of fact they are mostly as Birch Hirschfeld first suggested mixed tumors and belong to the embryonal adenosarcoma group. The embryonic rest from which they arise is very undifferentiated and very rapidly growing (*in lebhafter Vucherung begriffen*—Birch Hirschfeld). As a result certain tissues may grow more rapidly than the others and possessing a greater proliferative power and resistance may crowd the others out of existence and destroy them. Thus by a battle of the tissues (*Geueßkampf*—Askani) and a survival of the fittest one tissue type may command the field and make up the major or even the entire part of the growth. So a tumor beginning as an embryonal adenosarcoma by the eccentric development of one of its constituents may end up as a rhabdomyoma, a myosarcoma, a fibrosarcoma, a round cell sarcoma or a carcinoma. This is amply demonstrated in the pure enchondromata of the parotid and the strumas of the ovary which are really mixed tumors. Pure rhabdomyomata of the kidney never occur. They are all mixed tumors and so with most of the sarcomata and carcinomata of the kidney in childhood. In most of these tumors as Borst, Hedren, Birch, Hirschfeld and Wilms have shown a careful and extensive search will reveal a few of the typical round cell and epithelial (adenosarcoma) complexes described by Birch Hirschfeld.

FREQUENCY OF OCCURRENCE AGE AND SEX INCIDENCE

In 1924 Lubarsch was able to collect from the literature 137 cases of embryonal adenosarcoma. Of these 52 occurred in females, 66 in males and in 19 the sex was not indicated. In 55 cases the

neoplasm was on the right side, in 50 on the left side and in 6 the neoplasm was bilateral. In 25 the side was not indicated. The age incidence was as follows:

| Age | C | Age | Y | Cases |
|-------------|----|-----|---|-------|
| Fetuses | | | | 5 |
| and newborn | 4 | 10 | | 1 |
| 1 | 18 | 11 | | 1 |
| 2 | 24 | 12 | | 2 |
| 3 | 25 | 14 | | 1 |
| 4 | 18 | 15 | | 1 |
| 5 | 13 | 19 | | 1 |
| 6 | 6 | 23 | | 2 |
| 7 | 4 | 35 | | 1 |
| 8 | 4 | 57 | | 1 |

In 5 cases the age was not indicated. So it is seen that most cases occur within the first 5 years of life but cases have been reported as late as the fifty seventh and the seventy second year of life.

CONGENITAL FEATURES

The most striking evidence of the congenital nature of these tumors is their not infrequent bilateral occurrence. Associated developmental defects may also exist as in the case of Weigert in which in addition to a bilateral renal tumor bilateral undescended testes, hare lip and cleft palate were also present. Further the neoplasm may occur in several members of the same family as in the case of Walker in which a brother and sister were thus affected and the case of Struempell (cited by Walker) in which two brothers were afflicted with renal sarcoma.

SYMPTOMATOLOGY

The most striking symptom of malignant renal tumors in childhood is a large rapidly growing abdominal tumor unaccompanied by pain or hæmaturia. The patients seem to be in fairly good health except for the presence of the abdominal mass. As the tumor assumes larger proportions cough may set in. This is unusually reflex or due to mechanical causes but it may be the result of pulmonary metastases. Bladder symptoms are usually absent. Diminution or complete suppression of urine may result from compression of the ureter of the opposite side. Fever is present more often than in the renal tumors in the adult due to the rapid growth of the neoplasm and the unstable temperature mechanism in children. Gastro intestinal symptoms such as constipation or diarrhoea may occur but usually very late in the course of the disease. It is amazing how often a huge tumor filling half of the abdomen and displacing the entire peritoneal cavity to the opposite side produces no symptoms on the side of the gastro intestinal tract. According to Albarran

Trappe and Sand accepting the theory of Busse speak of these tumors as malignant embryonal nephromata

Robert Meyer following extensive embryological researches came to the conclusion that various tumors of the male and female urogenital tract originate as the result of an illegal tissue union of a mesodermal rest with the wolffian duct. These rests are then compelled by virtue of this union to accompany the duct in all of its migrations and often undergo neoplastic changes.

Lubarsch disputes the possibility of a metaplasia of smooth muscle to striated. He agrees with the theory of Wilms and Robert Meyer as explaining those cases in which striated muscle occurs and with the theory of Busse for the others.

HISTOLOGY

The predominating histological framework of the typical embryonal adenocarcinoma is that of an alveolar sarcoma. Scattered in the indifferent neoplastic round cell nests the epithelial complexes (*Druesenschlauche* of Birch Hirschfeld) are found. These epithelial complexes which are the keynote of these tumors assume various forms. In some cases the round cells take on an elongated form and an arrangement in rosettes suggesting epithelium. In others the cells are more cuboidal and they are arranged in tubular acini. While in still others definite cylindrical epithelium with a well defined basement membrane is found. The epithelium may in some cases undergo a proliferation forming compact epithelial nests and suggesting medullary carcinoma. Cysts may also develop as well as structures resembling glomeruli. In each case the round cells and epithelial cells are highly hyperchromatophilic and mitoses are frequent. If one examines the nests of round cells with their contained epithelial complexes the tubulo epithelial complexes in nests of indifferent round cell tissue under oil immersion one sees fine strands of connective tissue coursing among the round cells. Accompanying these delicate fibers are small capillary blood vessels.

The coarser framework supporting the alveolar round cell nests is made up mainly of collagenic connective tissue. Smooth muscle fibers are very frequently placed among the connective tissue fibers and are recognized by their long blunt ended nuclei and their yellow color with the Van Gieson stain. Elastic fibers are also occasionally seen.

Most interesting are the striated muscle fibers which are also frequently seen. They usually occur not in bundles but scattered among the connective tissue fibers. The sarcolemma is usually absent and tubular forms are frequent.

Fusiform cells in which no striations are visible but which take the Heidenhain iron hematoxylin stain occur. According to Wilms striated muscle occurs in about 40 per cent of these tumors. Myomatous connective tissue fat and cartilage may be present in this coarser supporting framework.

GROSS PATHOLOGY

Grossly the embryonal adenocarcinoma have a characteristic appearance. They are usually the size of a large orange, a grapefruit or larger and are well encapsulated from the surrounding renal tissue. On cut section the predominating cast is gray but due to necrosis and hemorrhage various shades of red and brown occur. Hyaline connective tissue and cartilage may show areas of glistening white producing a varicolored appearance. Cysts filled with a stringy mucoid material may be present so that when cut a viscid fluid clings to the knife. These tumors are often very brittle and when relieved of the restraining influence of the capsule by cutting they may fall to pieces. The neoplasm is usually on the lower pole of the kidney and grows from within out compressing the surrounding renal tissue which undergoes degeneration and helps to form the capsule. The tumor often grows into the renal pelvis completely occluding it. Here it often takes on a papillary form.

MODE OF GROWTH

The mode of growth is usually not infiltrating but crowding the tumor being well restrained by its capsule. At first while the neoplasm is still small the renal tissue is pressed aside and undergoes atrophic changes being stretched peripherally by the rapidly growing mass. Finally it forms a mere shell which fuses with the capsule of the tumor. The surrounding tissues are gradually pushed aside by a process of crowding. Adhesions to the periphery are usually absent. The colon is at first dislodged anteriorly and lies in front of the tumor. It is then pushed medially as the size of the neoplasm increases. The liver and the diaphragm are then gradually dislodged upward and the lower thoracic wall begins to bulge. Finally the entire abdomen is filled.

The growth is extremely rapid. Large tumors having been found in the newborn and even in fetuses while a growth scarcely appreciable at birth may increase to such size within a few months time as to fill completely the abdomen.

METASTASES

Metastases occur mainly by way of the blood stream the most frequent sites being the liver and



Fig 1



Fig 2

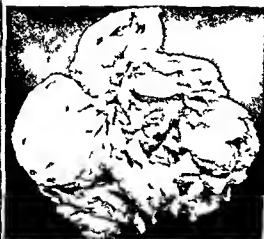


Fig 3

Fig 1 Embryonal adenosarcoma Case 2 The tumor lies on the lower pole of the kidney which has been destroyed by the growth The tumor has a well defined capsule

Fig 2 Embryonal adenosarcoma Case 3 Only the

upper pole of the kidney remains The tumor has completely filled the pelvis

Fig 3 Embryonal adenosarcoma Case 4 The friable white tumor mass lies on the lower pole of the kidney the upper pole of which is hydronephrotically dilated

Both round and epithelial cell showed many mitoses The supporting framework contained collagenic fibers fibroblasts and a few smooth muscle cells Striated muscle fibers were present in large numbers diffusely scattered Tubular forms and spindle shaped forms were also present There was no sarcolemma Elastic fibers were not present except in the capsule Small areas of necrosis and hemorrhage were noticeable

CASE 2 F I a girl 2 1/2 years old The family history was negative The child was a 7 months premature infant Previous history was negative except for varicella at 1 1/2 years of age For the past 3 weeks the parents have noticed a rapid increase in the size of the abdomen There was no pain no hematuria and no gastro intestinal symptoms

Physical examination disclosed a moderately well developed child The head neck heart lungs extremities and superficial lymph nodes were negative The left half of the abdomen was enlarged A mass the size of a child's head was palpable in the left flank It just reached the costal arch above and the midline anteriorly It was readily ballotable On January 4 under ether anesthesia Dozent Dr Koos did a midline laparotomy A tumor the size of a child's head and attached to the left kidney was removed from the left retroperitoneal region The ureter and renal vessels were readily tied off January 5 patient developed a left lower lobar pneumonia January 6 the wound broke open in its entire length January 15 the wound was granulating nicely the patient had a normal temperature January 26 patient was discharged from the hospital

Gross pathology (Fig 1) The tumor lay on the lower pole of the kidney and measured 12 by 9 by 6 centimeters It had a thick well defined capsule which fused with the capsula propria of the kidney The lower pole of the kidney had been destroyed by the tumor The upper and medial half of which was composed of a white papilloma like friable mass The lower and lateral half was made up of a firm lamellated tissue which contained shades of brown and reds due to hemorrhage The ureter pelvis and calyces were fairly intact

Histology (Figs 7 9 10 13 and 20) There were nests of indifferent round cell tissue containing epithelial cell groups in rosette forms and as cuboidal and cylindrical epithelium in the form of well defined acini Glomerulus like forms were present Fine connective tissue fibers appeared among the round cell Supporting the round cell nests was a coarse framework of collagenic fibers fibroblasts smooth muscle and a few small areas of loose edematous connective tissue A few striated muscle fibers including tubular and fusiform types were also present A few scattered elastic fibers were present in the stroma and in the capsule

CASE 3 A boy 2 years old The history was not obtained in this case

Gross pathology (Fig 2) The tumor was situated on the lower pole of the kidney with which it measured 12 by 6 by 6 centimeters Only the upper pole of the kidney remained The tumor was walled off from the periphery by a well defined capsule which fused with the capsula propria of what remained of the kidney The tumor presented areas of elastic consistency white in color and other areas which were more grayish yellow and were softer and more brittle (necrosis) In the center was a hen's egg sized area of very brittle spongy necrotic tissue infiltrated with blood and containing large clots The tumor had broken into and completely filled the pelvis as a solid mass compressing and infiltrating the renal parenchyma which it had perforated and presented on the external surface as a cherry sized mass A large portion of the pelvis and the upper portion of the ureter had been destroyed

CASE 4 A boy 2 years old The history was not obtained in this case

Gross pathology (Fig 3) The tumor was situated on the lower pole of the kidney with which it measured 12 by 6 by 6 centimeters Only the upper pole of the kidney remained The tumor was walled off from the periphery by a well defined capsule which fused with the capsula propria of what remained of the kidney The tumor presented areas of elastic consistency white in color and other areas which were more grayish yellow and were softer and more brittle (necrosis) In the center was a hen's egg sized area of very brittle spongy necrotic tissue infiltrated with blood and containing large clots The tumor had broken into and completely filled the pelvis as a solid mass compressing and infiltrating the renal parenchyma which it had perforated and presented on the external surface as a cherry sized mass A large portion of the pelvis and the upper portion of the ureter had been destroyed

Histology (Figs 6 16 22 23 and 24) There are nests of round cells with only an occasional grouping of cells to suggest epithelium A coarse supporting framework contained collagenic fibers fibroblasts and smooth muscle Striated muscle was not seen Elastic fibers were present in some of the large septa Fat tissue was also present Areas of necrosis and hemorrhage were found The renal parenchyma was compressed the tubules had disappeared and the glomeruli were closely packed to ether

CASE 5 S T a 4 year old boy A history was not obtained The child was operated upon by Dozent Dr Koos

and Imbert hæmaturia occurs as an early symptom in only 5 to 15 per cent of the cases. It is because of this absence of other signs especially of the alarming hæmaturia which brings the adult patient so early to his physician that these little patients come to the surgeon so late. Hence the poor prognosis in the operative result.

DIAGNOSIS

The diagnosis is usually made readily by palpation of a large abdominal mass. One should in this connection bear in mind that many of the large abdominal tumors in childhood are malignant renal tumors. Hydronephrosis may cause difficulty but this is usually ruled out by the different degrees of filling at various times.

THERAPY

Most surgeons (Israel Voelcker and others) agree that the cases should be operated upon regardless of the size of the tumor if metastases or severe cachexia are not present. Unless this is done the child will die within a year after the tumor is discovered. The youth of the patient is not a contra indication. Israel reports a successful operation in a 3½ month infant in which a tumor filling two thirds of the abdomen was removed. In a case reported by Abbe a 7½ pound tumor was removed from an 8 month child with recovery. Kynoch (quoted by Hedren) reports 7 cases successfully operated upon in young children.

Operative approach. Israel favors the retroperitoneal approach the line of incision following the long axis of the tumor. Voelcker's incision begins in the costovertebral angle and extends to the umbilicus. He opens the peritoneum widely. It seems however that the midline laparotomy incision which was used in the cases here reported and which is favored by most operators including Albarran is the best as it enables one better to explore the abdomen for metastases (liver mesenteric nodes etc.) and to determine if the tumor is bilateral. In either case one can immediately close and avoid subjecting the patient to an unnecessary operation. Israel and Voelcker both warn against mass ligatures of the renal pedicle and advise careful exposure of the large vessels. Because of the flexibility of the tissues in the child the vena cava and opposite renal vein can very readily be pulled over and caught in the clamp as in one case reported by Voelcker. In using the midline laparotomy incision one should always keep in mind the displacement of the peritoneum by the huge tumor. Thus in Abbe's case the peritoneal cavity was so far displaced

to the right by the left sided growth that a midline laparotomy incision brought him down on the tumor extraperitoneally (Fig. 8). If careful hæmostasis is carried out the smallest child will stand the operation well.

Many of these patients are operated upon merely on the diagnosis of abdominal tumor. Hence cystoscopy is often not done. It is alarming how frequently such a kidney is removed without a previous examination to assure the presence and adequate function of the other organ. Since these tumors are the result of a congenital malformation other congenital defects such as congenital absence of the other kidney may be present. Hence at least chromocystoscopy should be done in every case except in very young male children where intravenous pyelography will serve a well. Cystoscopic pyelography is usually unnecessary because the other clinical findings are typical.

PROGNOSIS

In a series of 20 cases not operated upon followed by Albarran and Imbert 14 died within 6 months 3 within one year 3 after 1½ years and only 1 survived 3 years. Deaths due to recurrences and metastases after operation usually occur within the first year but they may occur as late as the fifth. Hence Israel advises a 5 year period of observation before pronouncing a cure. The operative mortality according to Albarran and Imbert is about 25 per cent while the total early and late mortality including deaths due to recurrences and metastases reaches 80 per cent.

REPORT OF CASES

CASE 1. B. M., a girl 9 months of age. The family history was negative. Delivery was normal and she weighed 4000 grams at birth. The development history was negative. During the past month the parents have noticed a swelling in the size of the abdomen. There was no heart pain or other symptoms or signs.

Physical examination. The child weighed 8150 grams. The head, pericardium, lungs, and chest and superficial lymph nodes were negative. The left side of the abdomen was enlarged. At the top of the child's head was palpable a the left flank. It was readily movable and extended under the costal arch and to the midline in front. Examination in show of the diaphragm pushed up in the left and the liver displaced to the right. The red blood count was 3354000 white count 7000. Temperature was 99 degrees. June 3, 1914, operation was done under chloroform anesthesia. A midline laparotomy by Dozent D. Koo. A large left-sided retroperitoneal tumor at the left kidney was removed. The uterus and the renal vessels were easily displaced. The cyst was filled with pus, and the fluid was sent for culture. (F. 11, 12, 13, and 14). The tumor consisted mainly of nests of cells in round clusters in a connective tissue framework. The cells were arranged in a group of low cuboidal and cylindrical epithelial cells arranged in walls of ducts.



Fig 6



Fig 7

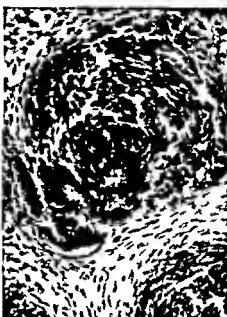


Fig 8

Fig 6 Low power photomicrograph showing nests of different round cell tissue in connective tissue framework resembling alveolar sarcoma (Case 3)

Fig 7 Low power photomicrograph showing nests of indifferent round cell tissue containing epithelial cell

groups. This is the typical picture of the embryonal adenosarcoma (Case 2)

Fig 8 High power view of round cell nests showing the assumption of an oval form by the cells and the arrangement in rosettes resembling epithelium (Case 4)

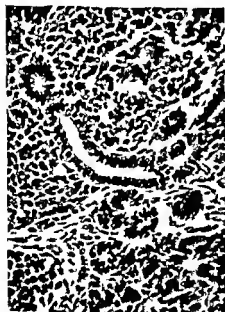


Fig 9



Fig 10

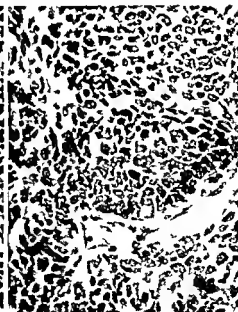


Fig 11

Fig 9 High power view of round cell nests. The cells have here developed into a well defined cuboidal epithelium forming an acinus with a well defined lumen. Rosette forms are also seen (Case 2)

Fig 10 High power view of round cell nests showing

well defined cylindrical epithelium (Case 2)

Fig 11 High power view showing development of epithelial cells into compact cell groups with hyperchromatophilia and many mitoses, somewhat resembling medullary carcinoma (Case 1)

quantity of albumin and many red blood cells. There were 2 leucocytes per high power field. The white blood count was 8,000 and the red count 3,480,000.

On June 11 an abdominal palpation was done under chloroform anesthesia. June 12 the temperature rose to 104 degrees, the respirations were 42. The child was

cyanotic and there was considerable dyspnea. Crepitant rales were audible over both lungs. Death occurred at 6 p.m.

Autopsy findings. Both kidneys were considerably distorted and largely replaced by a soft, white, friable tissue. It had a nodular structure, the largest nodules being the

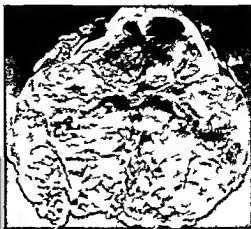


Fig 4 left Embryo 1 d m Cas 5 Th white t m m a c m posed of two spherical p ts and lies n the medi l pect of the kid y which thins t bo e and below to fse with the tumor cap le

Fig 5 Embryo al ad o a c m a C 7 Th t mo l es o th lower pole of the kid ey d fill ll fth p l s pt th pp calyx which dil t d The llo s struct re is well sh w

f ght ded renal t m A midline l p t my w m d u d ther anesthesia

Gr p th l gy (Fig 3) The tumor me s ed 14 by 10 by 9 tim t a d lay on the lower pole of the kid ey It w m d p m ly of a fa ly homogeneo s brittle white ma p t g so f gay (n c) b own a d d (hem rth g) A w l d d cap l which f ed w th th p l fth k d y w p t Th p l d ly w hyd ph t c ly d l t d n th p l s w f t t d Th u t c l d h f low d om p ssed t d th p l fth t mo

H t l gy (Figs 8 4 5 7 d) Nest f nd ll ta ed p th l al g o p ll tag f trans t f m tt f rm to cyl d cal p th h m Glom rul l k f rms w p esent Many mitoses w e ot d The pp tng fram w l w mainly a loo eco ect et s e with catt d fib obl ts d cells w dering cells nd m ypl c derable ced m w s t eabl M ny t h p d fib bl t weepes t c tng th t t mbl myx mat s t et ss Th w ca l smooth m l cell ma ly rou d th o d cl ts A f w not c mpl tely d l p d struted m cl fib rs d f w l a t c fib rs were p es t l a g e cas f p u n d l l tss e h w d ma y mitoses Th w ea f ecro is d hemorrhag

P t per l c Th t m recurred t th t f exturp t d th huld died 4 m ths fter th op rat n A t psy h wed ext ns e ecurce f th tum tss t th t fext rat n d meta t as in th bd mual lymph nodes d l Th h tologi tru tue w esse tually that of the primary tum pt th t rri ted m scl fib rs w re t p es t Gl m rul f rms w l d l ped

C s s G L boy f m ths F mly birth nd d l pm tal h t ry w g t Th p nts n t u ed rapid growth in th fth bd m n f w k N hem t m p in oth sympt m o g w p t B w l s w in d

Phy l m t Th skin h wed good t g th beuta eo f t w f ly w l d e d ped Th head

n k h t d l g t m tes and superfl l lymph nd w ng t e In th right de of the abd m n o g uezd mode tely h d m was palpable It e te ded pu der the liver a d medially b yo d the m dian Tempe ature was 00.4 degrees On A g st 5 Doe t Dr Koos r mo ed th ough a m d lapamotomy a d u d r ther a aesthes a tumor the u z of two ng Th t mo w s t tch d to the right k d y a d w th right p t l go The tum w ot dher t t th p nph y t th pe toneum C lesce ce w u t l l cept f complati g v r c ll Pat t s d h g d f m th h o p tal September 3 w th primary h l n fth w d

G p th l gy (Fig 4) The tumor ly on th m dial d l w d fth kid ey and me s d 3 by 6 by 8 tum t rs It w composed of tw phe c l parts m ll pp d d d by thin gluste ing white t u pta untop to che r y sized n d l s off ly el st c c aste cy a lower l rger h m g o s wht mass f l t c nstut cy The em fth k d ey th n d t bo d b l w t f w th w l d e l ped c p l of th t m Th u t p l c) ct e a d et d sap p n ma f t mo t whch comp es the l p l s

H t l gy Th we erou d cell ts co tain gep th lal gro p mpo ed f cubod l ep thel m ma y gl m rukus forms N l a t c t o strnat d m scl e was p esent

Case 6 G L 6 m th l d Fo the p t weeks a d h l f th p ts ha f l t mas n th right s d of the b d m n Th w o hemat r i a dapp tly op

Phy sc l m t e ealed well nshed w l d loped f m al child wh w gh d 5300 gram Th k i had good t g th e wa no ced m The bd m wa dist d d d m wh t ymet cally l a g d be som wh t m p m n t th ght de Und r th n ht tal m a g firm b l l ttable m f l t c ust cy d som what l g th a ppl wa p l p bl On th l f t d th w mewh t smalle mm ble ma th umbil us Th n c t ed a l a g



Fig 15



Fig 16



Fig 17

Fig 15 High power view showing the fine connective tissue or true stroma of the indifferent round cell nests of the embryonal adenosarcoma. The empty spaces A and B represent epithelial tubules. C a blood vessel and D and E the fine connective tissue fibers lying among the indifferent round cells. Bielschowsky-Maresch impregnation (Case 4).

showing upper left spindle cell sarcomatous tissue, in the middle collagenic fibers and fibroblasts, and in the lower right an area of necrosis with a few tubules still visible (Case 3).

Fig 17 Low power view of round cell nest and supporting framework. Arranged in a circle around the nest are many smooth muscle fibers recognized by their long blunt ended nuclei (Case 4).

Fig 16 Low power view of connective tissue framework

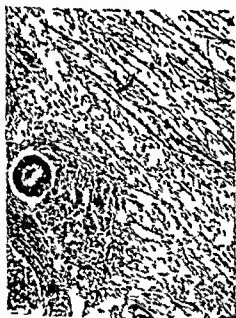


Fig 18



Fig 19

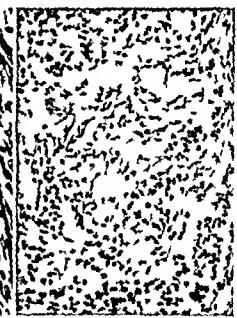


Fig 20

Fig 18 Low power view showing in the upper right hand corner numerous striated muscle fibers. Heidenhain iron haematoxylin stain (Case 1).

Fig 19 High power photomicrograph of area shown in Figure 18 showing well defined striated muscle including

fusiform and tubular forms. The fibers are scattered and there is found no sarcolemma. Heidenhain iron haematoxylin stain.

Fig 20 High power view of tumor showing loose edematous connective tissue (Case 2).

DEDUCTIONS

Whereas the typical embryonal adenosarcoma shows a typical histologic structure the atypical and aberrant types may lead us into difficulty

Ribbert claims to have seen in these tumors neuro epithelium such as occurs in mixed tumors of the testicle while other authors report ciliated epithelium. Wilms doubts if these forms ever occur. They were not seen in our cases.



Fig 27 High power view of another area of the cortex of the same kidney as is shown in Figure 26. Glomeruli in various stages of development are seen. The structure in the upper left hand corner represents a fairly well developed glomerulus with capillary loops well filled with blood. The others represent earlier stages (pseudo glomeruli) and closely resemble the glomerulus forms of the embryonal adenosarcomata. For comparison see Figures 13 and 14.

epithelium which all observers report. We have seen these various stages repeatedly in our cases as Figures 8, 9 and 10 demonstrate. Birch Hirschfeld considered the true stroma of the round cell nests with their included epithelial groups to be the fine connective tissue fibers with their blood supply which lie among the indifferent round cells. In our cases we have demonstrated this tissue with the aid of the Bielschowsky Maresch impregnation method as demonstrated in Figure 15. We have also examined histologically the kidneys (metanephros) of human embryos 7, 8, 9, 10, 14, 22 and 26 centimeters in length. In these just as Busse found the renal tubular parts were made up partly of undifferentiated round cells and partly of well defined epithelial cells exactly resembling the round cell nests containing tubulo epithelial cell groups of the embryonal adenosarcomata (see Fig 26). This finding strongly supports the theory of the metanephric origin of the embryonal adenosarcomata. Glomeruli in various stages of development were also seen some exactly resembling the glomerulus like forms of the tumors as in Figure 27. Most authors while admitting the resemblance of these structures to glomeruli look upon them as eccentric proliferations of the tubulo epithelial parts of the tumors and express some doubt as to whether they actually represent glomeruli. Kaufmann suggests that postembryon-



Fig 28 Sketch showing dislocation of the peritoneal cavity by a huge renal tumor in a 7 months child. A mid line laparotomy incision exposed the mass extraperitoneally (Case of Abbe).

ic development of glomeruli does not occur. But in this connection I believe we must not forget that these tumors represent embryonic tissue. Weigert in 1876 reported a case of bilateral congenital adenocarcinoma in a stillborn infant. This case is according to our view a typical adenosarcoma as the histological description and the accompanying illustrations prove. Glomerulus like forms were present. Weigert considered them to be embryonic glomeruli and identical in structure with the pseudo glomeruli which Toldt saw in his studies on the development of the kidney. These latter structures result from an eccentric proliferation of the embryonic renal tubular epithelium and represent a transitional form to the development of the true glomerulus.

As to the origin of these tumors as we have already stated above they undoubtedly represent metanephric tissue. The question as to whether they arise from the already differentiated metanephros itself (theory of Busse) or from a mesodermal rest containing metanephric anlage or nephrotom as Wilms believes may still be left open to discussion. If one accepts the possibility of a metaplasia of striated from smooth muscle the theory of Busse might explain all cases. But such a metaplasia has never been proved. So we would be compelled to accept the theory of Wilms which places the origin of the striated muscle cells in these tumors from the myotom portion of the mesoderm. But as is known only about 40 per

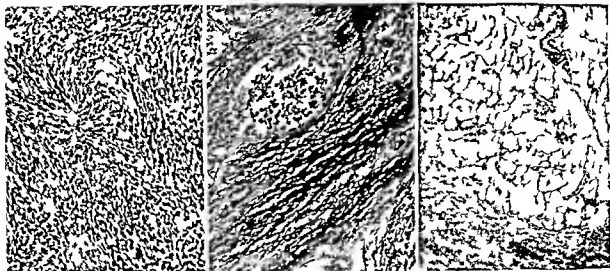


Fig 1 Low power view of spindle cells in a reticulated framework of the tumor (Case 4) (Ca 3)
 Fig 2 Low power view showing elastic fibers in the supratentorial region (Ca 3)
 Fig 3 Low power view of fetal tissue (Ca 3)



Fig 4 Low power view showing the compound renal pelvis (Case 7)
 Fig 5 High power view showing the renal pelvis (Case 7)
 Fig 6 High power view of the renal pelvis (Case 7)

Birch Hirschfeld considered the tubulo epithelial groups and the surrounding indifferent round cell tissue to exist not in the relation of tumor parenchyma and tumor stroma but to be both of epithelial origin. He referred to the round cells as archblastotic cells and believed that they could

develop into epithelial cells. The work of Hedrén in which he demonstrated in serial sections a gradual transition from the surrounding indifferent round cells to the epithelial tubules supports this view and also the various stages of development from mere rosettes to well defined

RADIATION THERAPY OF CARCINOMA OF THE BLADDER

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THE purposes of this paper are (1) to describe the methods of treating cancer of the bladder at the Memorial Hospital (2) to present an analysis of the radiation furnished by the use of radium and the roentgen rays and (3) to present results following radiation therapy.

Before undertaking the treatment of any bladder cancer it should be classified as to form, size, location, histological structure, amount of infiltration and the presence or absence of metastases. This information may be obtained by rectal palpation, cystoscopic examination, a biopsy from the base of the growth, and stereoscopic cystograms with the bladder inflated with air. The general condition of the patient must be ascertained with especial emphasis placed upon the cardiovascular and renal reserve.

A bladder cancer should never be treated with fulguration. The electric spark lacks power to destroy fully established cancer and clinical evidence suggests that such irritating treatments stimulate the tumor to a more rapid growth.

If the size and position of a papillary carcinoma are such that all of the base can be visualized accurately through the cystoscope (approximately 1.5 centimeter in diameter), the tumor may be treated successfully with interstitial irradiation by means of gold seeds inserted through the urethra. When all of the base cannot be seen clearly through the cystoscope, suprapubic cystostomy should be performed and gold seeds embedded under direct, unobscured vision.

Flat infiltrating bladder carcinomata, irrespective of size, should be treated with radium through the open bladder. The submucous extensions of this disease cannot be detected with sufficient accuracy by cystoscopic vision.

In performing suprapubic cystostomy for radon implantation certain details should be observed. Spinal anesthesia is recommended. Before opening the bladder the exposed layers of the abdominal wall are carefully protected with gauze to prevent tumor implants should any of the bladder contents be spilled. All manipulations are gentle.

The bladder is never separated from its attachments because we think this procedure of mobilization favors dissemination of cancer through lymphatics. Resection is never done. To facilitate burying gold seeds in the base of a papillary tumor the bulk of the intravesical projection is removed with the actual cautery or endotherm knife. We do not coagulate the base. After the base of the tumor has been exposed clearly, gold radon seeds of 2.0 millicuries each are buried throughout and to a distance of at least 1 centimeter beyond any visible or palpable evidence of involvement. The seeds are buried with precision 1 centimeter apart and 1 centimeter deep so that each seed marks the vertex of an equilateral triangle the sides of which are 1 centimeter in length.

Flat bladder cancers are treated in the same way except that there is no projecting tumor to remove. We carry out gold seed implantation regardless of the relationship between the tumor and the ureteral orifices. In only 2 cases has operation been necessary to relieve a blocked ureter.

From this description it may be observed that the number of millicuries of radon needed to treat any given bladder cancer depends entirely on the size of the growth. In several instances we have used more than 50 seeds aggregating over 100 millicuries without causing harmful results. We believe that the greatest danger of radiation therapy is the danger of inadequate dosage. Therefore if an ample supply of radium is not available some other method of treatment should be employed.

After treatment we keep the patient under close observation. Examinations are performed with such frequency that recurrences may be detected while they are small enough to be treated by endoscopic measures. Unfortunately the appearance of recurrences practically always means that the growth has progressed beyond control. For this reason it must be emphasized that in treating bladder cancers with radium the urologist must work with the purpose of curing the patient by the first operation. Therefore irradiation must be adequate and thorough.

Any intelligent discussion of the effect of radiation must be based on an estimate of the quantity actually concerned in producing the phenomenon. In the case of regression of a tumor mass if we

Gold d s ds f m l l r h b t n t t t d p h l f
t m t d t m t p t h g v s a t f t r y e s u l t s l f
p a l a s t h e s i s s e d p p h d d d t t r i g a t g s e l
t p m d t t b l d i g f m t h d i p k t h p t m y b
t u h b a s f t b t m O t h w a s t h p d m t b p t d
h b e o v d t l y l f t m p l t t u a m t b m
p l y d t 3 w k i t m t m h p s t h t v i w i l l b e b d
b y l g b p d d b y l i t t m t s

cent of these tumors contain striated muscle. *He therefore believes that the neoplastic proliferation of the metanephros may occur at any stage in its development from the mesodermal stage where in addition to the metanephric anlage striated muscle anlage or myotome is present to the stage where actual metanephros has differentiated and striated muscle anlage is no longer present. Hence the earlier origin (theory of Wilms and Robert Meyer) could be ascribed to those cases where striated muscle is present and the later origin to those cases where it is absent.*

The high total early and late mortality (86 per cent) of malignant tumors of the kidney in childhood is not so amazing when we compare this figure with that of malignant renal tumors in the adult (70 to 80 per cent). Especially so when we consider how late these children usually come to the surgeon due to absence of alarming symptoms and the rapid growth of the neoplasm.

SUMMARY

1. Most large abdominal tumors in childhood are malignant tumors of the kidney.

2. Most malignant tumors of the kidney in childhood are mixed tumors of the embryonal adenosarcoma group.

3. An extensive histological study of every case of renal tumor in childhood is urged. Sections should be taken from every part of the neoplasm and a careful search made for the typical epithelial groups which will identify the tumor as an embryonal adenosarcoma. The failure to demonstrate these epithelial groups does not exclude the possibility that the tumor belongs in this group.

4. The embryonal adenosarcomata arise from the metanephros. The neoplastic change of the latter may occur at any stage in its development from the mesodermal stage where it is present only as metanephric anlage to the point where actual metanephros has already differentiated. The earlier origin may be ascribed to those cases in which striated muscle is present and the later origin to those cases where it is absent. The glomerulus like structures in these tumors represent true embryonic glomeruli.

5. The most outstanding symptom of malignant renal tumors in childhood is usually a rapidly growing painless abdominal tumor. Hematuria is usually absent.

6. The midline laparotomy incision is preferred.

7. Cystoscopic study of every case is urged to asure the presence of a functionally efficient kidney on the other side. In very young male children intravenous pyelography may suffice.

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u d H st l g H ke Lub sch Be l n J l
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6. MARCH ND My sa com St oc l l e d r N e
A h f p th A t 878 lxx 89
7. MEYER ROB RT U b Emb yon l G w bs
schl d we b h G it l u d Ih
B d t g f d P th logi d e Org
E g b d llg P th path A t 9 5 l 5 9
8. Id m U b Emb y l G websa mal e h
p thol s he B d t g m allg m e u d
sol he d ma lch Ge tal App t m
W so d E g b d llg Path p th A t
9 43
9. Id m C t d by L b ch
R BE R U b My s m St c l l des
N e b k s u d U t Arch f p th Anat
886 8
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St t t g 9 5 pp 45
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F nk f Z t h f P th 9 7 l 3
3. VO LC ER d B m GHASU D solid G sch
w l t d N H d b d U ol 9 7 7
4. W LK A S g 899 x 5 9
5. W R Id cin ma m Co g t A h
f p th A t 876 l 49
6. W l Ad sa k m d N A h f p th Anat
9 3 6
7. W M D M hgeschw el t L p g A th
G 899 pp 9

TABLE I—DEPTH DOSES FROM HIGH VOLTAGE
ROENTGEN RAYS AND RADIUM ELEMENT
PACK

| D ph | ROENTGEN RAYS | RADIUM ELEMENT PACK | |
|------|---|--|--|
| CM | oo k l volt 5 m T S D t 5 mm C d 5 mm Al fit oo q m f l d | 3 mm Pt d 5 q m l 5 mm b 5 mm t 5 mm g 5 mm u 5 mm r 5 mm f 5 mm e | 5 mm b 5 mm t 5 mm g 5 mm u 5 mm r 5 mm f 5 mm e |
| | | cm d t e | 5 m d t |
| 0 | 100 | 100 | 100 |
| 1 | 99 | 81 | 86 |
| 3 | 85 | 59 | 67 |
| 5 | 67 | 44 | 53 |
| 7 | 52 | 33 | 43 |
| 10 | 33 | 23 | 31 |
| 12 | 25 | 18 | 19 |
| 15 | 17 | 13 | 14 |

| | | | | | | | | | | | | | | | |
|----|----|---|------|-----|----|----|-----|----|---|---|---|----|----|---|---|
| TS | ta | g | t-sk | dis | ta | Cu | ppe | Al | l | m | m | Pt | pl | t | m |
|----|----|---|------|-----|----|----|-----|----|---|---|---|----|----|---|---|

TABLE II—TISSUE DOSES FROM A TWO MILLI CURIE GOLD RADON SEED AT DIFFERENT DISTANCES

| Data | | Tis dose | | D t | | Tss d se | |
|------|---|----------|-------|------|---|----------|----|
| Cm | P | c | t SED | Cm | P | t SED | |
| 0 5 | | | 950 | 2 35 | | | 50 |
| 0 6 | | | 700 | 2 5 | | | 45 |
| 0 7 | | | 465 | 2 75 | | | 40 |
| 0 8 | | | 350 | 3 0 | | | 35 |
| 0 9 | | | 275 | 3 5 | | | 30 |
| 1 0 | | | 230 | 4 0 | | | 25 |
| 1 2 | | | 140 | 4 5 | | | 20 |
| 1 4 | | | 110 | 5 0 | | | 15 |
| 1 6 | | | 90 | | | | |
| 1 8 | | | 75 | | | | |
| 2 0 | | | 70 | | | | |

Thresh ld ryth ma d

With the aid of this table if we had a chart of any bladder tumor with the locations and strengths of the seeds which had been implanted we could measure all their distances from any selected point and find the total tissue dose at that point due to the individual seeds. If a seed were greater or less than 2 millicuries the corresponding tissue dose would be proportionately greater or less.

It is impracticable to do this in actual cases. However it is comparatively simple to represent diagrammatically the various shapes and sizes of tumor masses that might be expected to occur. These growths are so flat and thin that we may consider all the seeds to lie in a single plane. As has already been stated our usual method of using gold seeds in bladder tumors 2 centimeters or more in diameter is to expose the growth surgically and implant seeds of approximately 2 mil

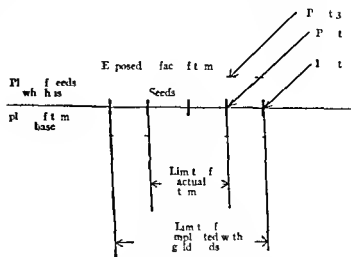


Fig. 2 Implantation of seeds

licures each spaced 1 centimeter apart at the vertices of equilateral triangles throughout the mass and to a distance of 1 centimeter beyond it on all sides. Accordingly diagrams of a number of possible lesions were made on centimeter cross section paper the distribution of seeds indicated thereon the distances from each seed to selected points measured and the individual tissue doses determined. Three points were used for each diagram two in the plane of the seeds which is supposed to be the plane of the base of the tumor and one on the exposed surface of the growth. Point 1 in each case is at the periphery of the actual mass in the plane of the seeds point 2 is 1 centimeter farther out at the edge of the area in which seeds were implanted point 3 is directly above point 1 on the exposed surface of tissue. The same dose would of course be received at a similar distance below the plane of the seeds. Figure 2 shows this scheme diagrammatically. The first point gives the minimum dose for the tumor base the third gives the minimum dose for the surface of the growth the second indicates our factor of safety for possible infiltrations of tumor cells which are not clinically demonstrable.

Table IIIA shows the diagrams and calculations for points 1 and 2 for circular masses 2 centimeters and 4 centimeters in diameter respectively. Table III gives the complete data for several more of different shapes and sizes covering the range which might be expected clinically. The first column gives the size and shape of the mass considered the second third fourth and fifth the amount of radon used and the tissue doses under our present scheme of treatment the 4 following the same data for seeds of 1 millicurie instead of 2 millicuries and the last 4 for a spacing of 1.5 centimeter instead of 1.0 centimeter.

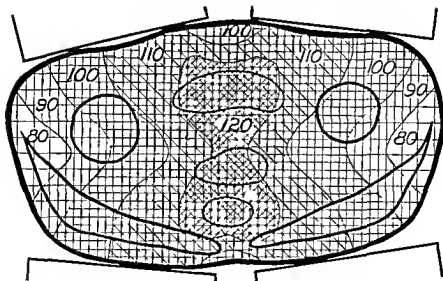


Fig. Cross section of pelvis showing distribution of roentgen rays through four skin portals for the bladder by high voltage

consider the effect of a direct one on malignant tissue it is essential to know the amount of radiation arriving at the growth. It is obvious that all points of an irradiated mass cannot receive the same amount of energy; this is particularly true when interstitial radiation is employed. If tumor regression depends on every point receiving at least a certain definite amount, then it is necessary to know the quantity delivered at the point which receives the minimum. It is evident that for external radiation a knowledge of the amount leaving the source or falling on the skin is of little value because the amount delivered at a point within the body varies enormously with the depth below the skin. In the case of interstitial radiation a knowledge of the amount used is not sufficient. We must also know the size and shape of the mass, the distribution of the sources, and the manner in which the effect varies with the distances from the sources.

For convenience we may call the amount of radiation delivered at a given point in the tissue the tissue dose at that point. It is necessary then to have a unit of quantity of radiation in terms of which these doses may be expressed. At the Memorial Hospital this unit is the threshold erythema dose. This is defined as the amount of radiation which after a single application will produce in 80 per cent of all cases a faint bronzing or reddening of the skin in about 3 weeks and in the other 20 per cent will produce no visible effect. Arguments for the use of this unit have been published previously (1 and 5). The threshold erythema doses for the sources of radium and

the roentgen rays in use at the hospital have been determined by skin tests on a large number of patients. By means of physical experiments the percentage of the amount of radiation falling on the skin which arrives at any depth within the tissue has been determined. For the treatment of bladder tumors the external sources used are the high voltage roentgen rays and the radium element pack. Table I shows the percentage of surface radiation arriving at various depths for the applicators.

From this table if we know the amount of radiation falling on the skin at each portal in terms of the threshold erythema (SED) and if we know the depth of the tumor below each portal we can determine at once the tissue dose from external radiation. Figure 1 represents a cross section of a pelvis showing the irradiation of the bladder of a medium sized individual by high voltage roentgen rays through four skin portals. It is seen that the total tissue dose throughout the bladder region is about 12 erythema doses—120 per cent threshold erythema.

For interstitial radiation the problem is not so simple. The interstitial sources used in the treatment of bladder tumors at Memorial Hospital are gold seeds about 4 millimeters long of 3 millimeter wall thickness and of about millicurie radon content. Work previously published makes possible the determination of the percentage of a threshold erythema dose delivered at any distance from any gold seed (6 and 7). The values for a seed of 2 millicuries at different distances are shown in Table II.

TABLE IIIA—DIAGRAMS AND CALCULATIONS FOR POINTS 1 AND 1 FOR CIRCULAR MASSES TWO AND FOUR CENTIMETERS IN DIAMETER RESPECTIVELY

| Gold r 1 seeds—2 mc a h—1 m p t d e p e p h r y f t m l cm t s d d t h d—p t S E D | | | | | | | | | |
|--|------------|---|---|---|-------------|---|---|---|---|
| m t m r—o red—35 m | | | | | P c t S F D | | | | |
| Seed N | P | t | S | F | D | t | S | J | N |
| | Per ph r y | | | | | | | | |
| 3 | 5 | | | | 9 | | | | |
| 4 | 45 | | | | 5 | | | | |
| 5 | 9 | | | | 700 | | | | |
| 6 | 35 | | | | 35 | | | | |
| 7 | 1 | | | | 00 | | | | |
| 8 | 80 | | | | 700 | | | | |
| 9 | 75 | | | | 45 | | | | |
| 10 | 700 | | | | 3 | | | | |
| 11 | 4 | | | | 7 | | | | |
| 12 | 35 | | | | 7 | | | | |
| 13 | 75 | | | | 35 | | | | |
| 14 | 700 | | | | 7 | | | | |
| 15 | 35 | | | | 5 | | | | |
| 16 | 80 | | | | 35 | | | | |
| 17 | 45 | | | | 6 | | | | |
| 18 | 9 | | | | 35 | | | | |
| 19 | 5 | | | | 1 | | | | |
| T tal | 39 | | | | 455 | | | | |

| 4 m t m r—37 ds—74 m | | | | | | | | | |
|----------------------|-----|---|---|-------------|-----------------|---|---|---|---|
| P c t S F D | | | | | P r c e t S E D | | | | |
| 4 m | t | m | r | —37 ds—74 m | P | r | c | e | t |
| | | | | | | | | | |
| 3 | 5 | | | | 5 | | | | |
| 4 | 45 | | | | 5 | | | | |
| 5 | 9 | | | | 35 | | | | |
| 6 | 35 | | | | 5 | | | | |
| 7 | 1 | | | | 4 | | | | |
| 8 | 80 | | | | 60 | | | | |
| 9 | 75 | | | | 5 | | | | |
| 10 | 700 | | | | 3 | | | | |
| 11 | 4 | | | | 75 | | | | |
| 12 | 35 | | | | 80 | | | | |
| 13 | 75 | | | | 5 | | | | |
| 14 | 700 | | | | 5 | | | | |
| 15 | 35 | | | | 35 | | | | |
| 16 | 80 | | | | 5 | | | | |
| 17 | 45 | | | | 35 | | | | |
| 18 | 9 | | | | 700 | | | | |
| 19 | 5 | | | | 5 | | | | |
| T tal | 39 | | | | 35 | | | | |

| P t t e d g f t m p l f e e t f s e d p o t t u m t t d f t m i n m p l | | | | | | | | | |
|---|-----|--|--|--|-----|--|--|--|--|
| 3 | 5 | | | | 5 | | | | |
| 4 | 45 | | | | 5 | | | | |
| 5 | 9 | | | | 35 | | | | |
| 6 | 35 | | | | 5 | | | | |
| 7 | 1 | | | | 4 | | | | |
| 8 | 80 | | | | 60 | | | | |
| 9 | 75 | | | | 5 | | | | |
| 10 | 700 | | | | 3 | | | | |
| 11 | 4 | | | | 75 | | | | |
| 12 | 35 | | | | 80 | | | | |
| 13 | 75 | | | | 5 | | | | |
| 14 | 700 | | | | 5 | | | | |
| 15 | 35 | | | | 35 | | | | |
| 16 | 80 | | | | 5 | | | | |
| 17 | 45 | | | | 35 | | | | |
| 18 | 9 | | | | 700 | | | | |
| 19 | 5 | | | | 5 | | | | |
| T tal | 39 | | | | 37 | | | | |

RESULTS

An accurate computation of end results following the use of any method of treatment is of value principally in furnishing a basis of comparison with the end results of other methods. In a study of carcinoma of the bladder the comparison is between radiation and surgery. Although radiation therapy of bladder cancer is still in a developmental stage the writers believe that it can be demonstrated that (1) the use of physical agents offers success where operation short of total cystectomy can offer nothing (2) the use of radiation is attended with a lower primary mortality and (3) with radiation the tumor is controlled more effectively than with surgery alone.

At the Memorial Hospital we do not refuse radium implantation to any patient whose cancer is confined to the bladder or who is not moribund from the effects of prolonged disease. Many of the cancers we treat are so extensive as to involve a third or more of the bladder. In 62 per cent of the patients we have operated upon, cancer touched the ureteral orifices the trigone or both. A large proportion of these cases would be considered inoperable from the standpoint of surgery

alone. Of course they would not be included in surgical end results.

In regard to operative mortality the use of radiation is much to be preferred. In practicing segmental resection which not infrequently requires ureteral transplantation the most skillful surgeons have an operative mortality of from 10 to 20 per cent. In 106 consecutive operations with the implantation of gold seeds our operative mortality was 3.7 per cent.

Following Broders' classification of epithelial tumors on the basis of malignancy certain surgical end results have been published which include the follow up record of all four groups. These have included many tumors of group 1 which are benign papillomata. Such figures are not relevant to a study of cancer. It should be clearly understood that no benign tumors are included in this series.

Perhaps some misunderstanding has arisen in the past concerning the use of the term "controlled" as applied to tumors that have been irradiated. Our patients in whom the carcinoma has been controlled present no symptoms nor signs of disease after the most painstaking examination

not controlled although 4 patients lived from 3 to 8 years after irradiation. The fact that approximately 80 per cent of the uncontrolled patients died within years of treatment indicates a large field for improvement. In general these were the most advanced cases many were recurrences after operation. Probably we can better these results by modifying our methods but radical improvement will come only when earlier diagnoses are made and when the initial treatment is more effective.

In Table V the tumors are classified on the basis of clinical examination. Solid club shaped sessile tumors often multiple when partly or wholly covered with slough were diagnosed papillary carcinoma. Of this group of 45 cases 25 or 55.5 per cent have been controlled for from 3 to 13 years.

The discrepancies between the clinical and histological diagnoses in Tables IV and V are accounted for partly because a few cases of clinical cancer were diagnosed in the laboratory as papilloma and a number were considered to show histological evidence of infiltrating the bladder wall. In the majority of cases the diagnosis is the same by each standard.

Tables VI and VII indicate the results with infiltrating cancers. The histological evidence of this type of tumor consisted in the presence of cancer cells invading the structures of the bladder wall. Marked induration of the base of the tumor was considered positive clinical evidence of infiltration. This feature was detected by digital palpation or was demonstrated when radium needles encountered tumor tissue of the density of leather. Frequently infiltration of the bladder wall by tumor was shown in the cystograms but such findings were not made the basis for a positive diagnosis.

In comparing Tables VI and VII it will be noted that all of the tumors diagnosed as infiltrating by histological examination were found to have clinical features of infiltration as well but a large number of tumors were classified as infiltrating on the basis of clinical observation when the microscopic findings could not detect invasion of the bladder wall. It is likely that in these cases the biopsy specimens did not contain sufficient tissue from the base of the tumors. That there was probably no great discrepancy between the characters of these tumors whether diagnosed by histological or clinical methods is shown in the results after treatment. In each group the patients controlled for more than 3 years after radiation comprised approximately 30 per cent of those treated.

SUMMARY

If the base of a papillary carcinoma is no larger than 1.5 centimeter in diameter and is entirely visible through the cystoscope the tumor may be treated successfully with gold radon seeds implanted through the urethra. Larger papillary cancers and all infiltrating tumors should be treated under full vision with the bladder opened.

The operation of suprapubic cystostomy with implantation of radon seeds requires painstaking technique the most important features of which are protection of the wound against tumor implants great gentleness never mobilizing the bladder accurate radon implantation and an adequate number of gold seeds of proper strength.

Careful estimates show that a threshold erythema dose is about as large a dose as can reach a bladder tumor from a single pelvic cycle of 4 high voltage roentgen ray treatments.

A table is presented which indicates the tissue dose of radiation delivered at various distances from a 2 millicurie gold seed. With the aid of this table and diagrams representing cross sections of the base of bladder tumors the minimum tissue dose that we use in treating bladder cancers was found to be between 20 and 25 threshold erythema doses. A centimeter beyond all demonstrable tumor the tissues receive from 20 to 30 threshold erythema doses. We believe that this is an important factor of safety in view of the great difficulty in estimating accurately the extent of an infiltrating tumor. These figures indicate the greater intensity of interstitial radiation and perhaps explain the failure of many attempts to cure bladder tumors with treatment derived from external sources.

We use relatively large doses of interstitial radiation because it is essential that malignant tumors in an organ as inaccessible as the bladder should be cured by a single treatment.

Our results indicate that with the use of adequate doses of interstitial radiation

1. We can offer hope of cure to patients to whom operation alone short of total cystectomy can offer nothing.

2. Our operative mortality is less than that from surgery alone in the proportion of 3.7 per cent compared with 10 to 20 per cent.

3. In a series of papillary bladder cancers between 43 and 55 per cent of the patients are free from symptoms and signs of disease 3 years after treatment.

4. In a series of infiltrating bladder cancers between 27.8 and 31.8 per cent of the patients are free from symptoms or signs of disease 3 years after treatment.

TABLE IV—PAPILLARY CARCINOMA OR PAPILOMA WITH ATYPICAL CELLS—DIAGNOSIS MADE BY HISTOLOGICAL NOT CLINICAL EXAMINATION

| | Cases | Per cent |
|--------------------|-------|----------|
| Number of cases | 51 | |
| Controlled | 7 | 52.9 |
| Controlled 3 years | 22 | 43.0 |
| Not controlled | 4 | 47.1 |
| Summary—Year | | |
| Less than 1 year | 2 | 10 |
| 1 to 3 | | 9 |
| 3 to 4 | 2 | 1 |
| 4 to 5 | 3 | |
| 5 to 6 | 6 | |
| 6 to 7 | 1 | 0 |
| 7 to 8 | 3 | 1 |
| 8 to 9 | 3 | |
| 9 to 10 | 3 | |
| 10 to 11 | 1 | 0 |

TABLE V—PAPILLARY CARCINOMA DIAGNOSIS CLINICAL PAPILOMA WITH ATYPICAL CELLS ARE INCLUDED

| | Cases | Per cent |
|---|-------|----------|
| Number of cases | 45 | |
| Clinical and histological diagnosis | 36 | |
| Clinical and histological diagnosis and gross | 9 | |
| Controlled | 3 | 66 |
| Controlled 3 years | 5 | 55.5 |
| Not controlled | 5 | 33.3 |
| Summary—Year | | |
| Less than 1 year | | 3 |
| 1 to 3 | 2 | |
| 3 to 4 | 6 | |
| 4 to 5 | 3 | |
| 5 to 6 | 3 | |
| 6 to 7 | 3 | |
| 7 to 8 | 2 | |
| 8 to 9 | 2 | |
| 9 to 10 | 5 | |
| 10 to 11 | 1 | |
| 11 to 12 | 0 | |

TABLE VI—INFILTRATING CARCINOMA—DIAGNOSIS MADE BY HISTOLOGICAL NOT CLINICAL EXAMINATION

| | Cases | Per cent |
|--------------------|-------|----------|
| Number of cases | 44 | 43 |
| Controlled | 9 | 43 |
| Controlled 3 years | 4 | 38 |
| Not controlled | 25 | 56.9 |
| Summary—Year | | |
| Less than 1 year | 2 | 12 |
| 1 to 3 | | 7 |
| 3 to 4 | | |
| 4 to 5 | | 1 |
| 5 to 6 | 2 | 1 |
| 6 to 7 | 2 | 0 |
| 7 to 8 | | |
| 8 to 9 | | |
| 9 to 10 | 3 | 1 |
| 10 to 11 | | 0 |
| 11 to 12 | 0 | 0 |
| 12 to 13 | | 0 |
| 13 to 14 | | 0 |

TABLE VII—INFILTRATING CARCINOMA—DIAGNOSIS CLINICAL

| | Cases | Per cent |
|---|-------|----------|
| Number of cases | 82 | |
| Clinical and histological diagnosis | 44 | |
| Clinical and histological diagnosis and gross | 38 | |
| Controlled | 3 | 36.5 |
| Controlled 3 years | 3 | 7.8 |
| Not controlled | 5 | 63.5 |
| Summary—Year | | |
| Less than 1 year | | 2 |
| 1 to 3 | | 2 |
| 3 to 4 | | 4 |
| 4 to 5 | | 3 |
| 5 to 6 | | 3 |
| 6 to 7 | | 4 |
| 7 to 8 | | 3 |
| 8 to 9 | | 2 |
| 9 to 10 | | 3 |
| 10 to 11 | | |
| 11 to 12 | | |
| 12 to 13 | | |
| 13 to 14 | | |

We do not use the word "cured" because we do not as yet know all of the criteria of ultimate success in the treatment of bladder cancers.

The results obtained from radiation applied to papillary carcinomata are indicated in Tables IV and V. Not infrequently there is a difference of opinion between the clinician and the pathologist regarding the exact nature of a tumor. Compared with the histological diagnosis, clinical observations are not to be despised, especially in those cases in which only a small fragment from a superficial part of the tumor has been submitted to the

pathologist. In order to prevent any question arising as to the standards by which the tumors were diagnosed, separate classifications are presented.

The tumors of Table IV were diagnosed purely by histological criteria. Their general structure was papillary but atypical or cancerous cells were present. Of the 51 cases comprising this group, 27 or 52.9 per cent have been controlled to date. Twenty-two or 43 per cent of the entire group have remained free from disease for from 3 to 10 years after irradiation. Forty-seven per cent were

URINARY INCONTINENCE FOLLOWING CHILDBIRTH,
ITS SURGICAL TREATMENT

H W JOHNSTON M B F R C S (Edin) TORONTO CANADA

J Obstetric Gynaecologist To the Gynecological

A GREAT deal has been written on incontinence of urine in the female and many varied have been the operations to relieve it. It is of common occurrence a very distressing symptom and often made light of—the women taking it as a natural sequel to childbirth and resigning themselves to this annoying condition.

Taylor and Watt reviewing the records of 1006 gynecological cases in the Roosevelt Hospital found incontinence in 15 per cent and the percentage increased with the number of children the patients had borne.

That incontinence of urine is always associated with cystocele prolapse of the vault or uterus is incorrect. Very often the reverse is true a bad procidentia having complete control.

It depends upon the displacement of the upper part of the urethra that part which is held in position by the triangular ligament and surrounded by the sphincter urethra or compressor urethra. As long as the sphincter urethra muscle remains intact the control is good. This muscle supports the upper part of the urethra and when it is torn allows a sagging of this part so that when the patient coughs or sneezes the urethra becomes displaced the meatus looking upward and forward and the urine being expelled in a spurt.

THE ANATOMY OF THE FEMALE URETHRA
AND ITS ATTACHMENTS

The base of the bladder rests upon and is supported by the deep layer of the triangular ligament and a musculo-fascial sheet the so called pubocervical layer of pelvic fascia which separates it from the anterior vaginal wall. Tearing of this musculo-fascial sheet allows a herniation of the bladder to occur—a cystocele. The triangular ligament is perforated anteriorly by the urethra and the part of the urethra lying between the two layers of the ligament is surrounded by a striped muscle of goodly size—the sphincter urethra. It is the voluntary muscle of micturition. The sphincter embraces the urethra. The component fiber bundles arise from the fibrous tissue in the angle beneath the symphysis pubis and from the descending pubic ramus. They pass analward and medialward on each side of the urethra interdigitating across the median line

and joining their fellows of the opposite side (Fig 1).

The fibers posteriorly as well terminate in the anterior vaginal wall to which they are firmly attached (Fig 2).

The anterior group of fibers are well protected and are rarely torn (Fig 3). The posterior and sling group of fibers lying between the urethra and the vaginal wall are easily torn by the advancing head as it forces the vaginal wall downward in its descent and tears the muscle bundles that are attached thereto. If the pressure is severe and prolonged those bundles interdigitating across the midline are also damaged.

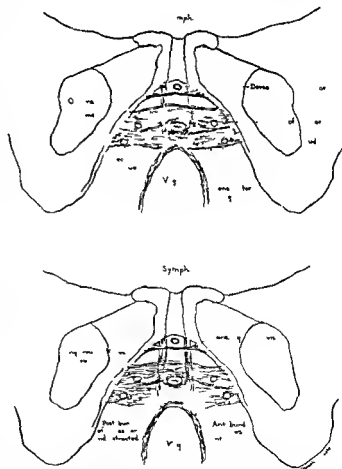


Fig 1 Diagram showing the three groups of muscle bundles composing the sphincter urethrae muscle and their relation to the urethra and the anterior vaginal wall. The lower part of the diagram shows the posterior and sling group of fibers torn and their retraction upward and outward.

From our experience with radium therapy as it is employed at the Memorial Hospital we believe that an adequate dose of interstitial radiation is preferable to surgery alone in the treatment of both papillary and infiltrating types of bladder cancer because after radium implantation the operative mortality is less and a higher percentage of patients are found free from disease 3 years after treatment

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URINARY INCONTINENCE FOLLOWING CHILDBIRTH, ITS SURGICAL TREATMENT

H W JOHNSTON M.B. I.R.C.S. (Edin) TORONTO CANADA
J Obstet Gynaecol Sg Trt G Int Jnt

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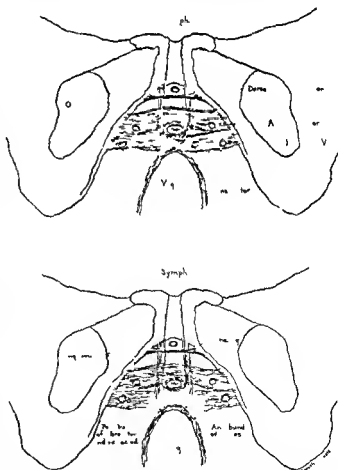
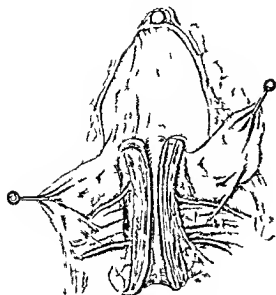


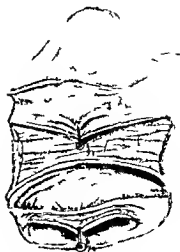
Fig 1 Diagram showing the three groups of muscle bundles composing the sphincter urethra muscle and their relation to the urethra and the anterior vaginal wall. The lower part of the diagram shows the posterior and sling group of fibers torn and their retraction upward and outward.



(f t p l) m d f m d i c t b y t h t h o
 (h i d t h t h a i l d p l o g t p t w a l l
 d t h l w l l a s t c d l a t e a l l y O e a s
 t h e t b l i t r s l b m m e t n t h
 t o l y f t h t g n d t h p h t e r u t h æ
 m c l (p t e g o p o f i b e) l y g b t w e e n t h t
 l a y i f t h l g m t D e p t t h e l m e t c a b
 t h p h t æ T h e t h r l p h c t e f i b
 a t t a d d t t h t r n v n l w l l d e d t d
 w a y w t h d f i l t y

The torn muscle now retracts and the intervening space is filled in by scar tissue so the efficiency of the sphincter is weakened (Figs 1 and 4). Microscopic and macroscopic examinations of the internal or vesical sphincter show it to be a small muscle. It is the thickened circular group of muscle fibers around the neck of the bladder is involuntary in its action and being part of the viscus descends with it unhurt in childbirth (Figs 2 3 and 4). Bonney in his paper on diurnal incontinence describes the structures surrounding the urethra as the peri urethral edge. Thus I take to be the internal sphincter the two layers of the triangular ligament and the structures lying between the two layers of the ligament. He considers the sphincter to play only a small part in urinary control and he is inclined to think that control is helped by tightening the anterior end of the pubocervical muscle sheet.

That the sphincter urethræ is the important factor in maintaining control is borne out by the fact that control is good when it is intact and poor or lost when it is not. There is no doubt



I g 3 Th s a d t f t h u t h r d t h e
 y m p h y s s p b O c t h t l a y e o f t h e t g e
 w t h t h s p h t t h æ m l (t e g p o f
 m u s l f i b b t w t h e t l y r s) T h b l d d r
 c k b g h l d b k f m t h t r i g b y a h k T h e
 t h r h k d w g t h e s u p e r f i l l y o f t h t r i g e
 o t h p h t u e t h æ m s c l e

that tightening the anterior end of the pubo cervical sheet should help it as some fibers of the sphincter urethræ spread themselves out on the vaginal wall but the bulk of the muscle shrinks outward and upward when it is torn and so should be located and the torn ends approximated if good control is desired. I do not mean to imply that the supporting structures are of no importance. On the contrary the stronger and tauter they are the firmer the *point d'appui* for the sphincter and the more efficient its action. So also if a cystocele exists it should be repaired by drawing across the torn sides of the pubo cervical sheet which extends from the symphysis pubis to the cervix and on which the bladder rests. By repairing the supporting mechanism the bladder is again in its normal anatomical position—the frequency of micturition is helped and a firm base formed for the sphincter. The cystocele is repaired by the method suggested by Professor Watson in the *British Medical Journal* of September 1924.

TREATMENT

I shall briefly review a few of the operations that have been performed.

1 Insertion of a pessary. This is a useless procedure as it does not help to relieve the anatomical defect which is the cause of the disturbance.

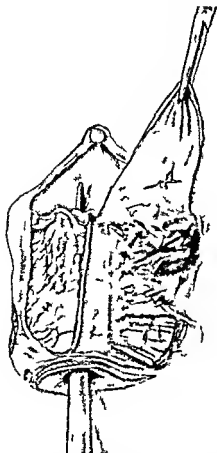


Fig. 4. This is a dissected specimen of a woman who died in the Medical Wards of the Toronto General Hospital from pulmonary tuberculosis. She had had a difficult childbirth 7 years before and had suffered from incontinence of urine. The probe is in the urethra the end lying just below the clitoris. The anterior vaginal wall has been medially incised and one side dissected showing the torn end of the sphincter urethra muscle lying just below the deep layer of the trigone and retracted outward. One can also see the sphincter vesicae surrounding the neck of the bladder.

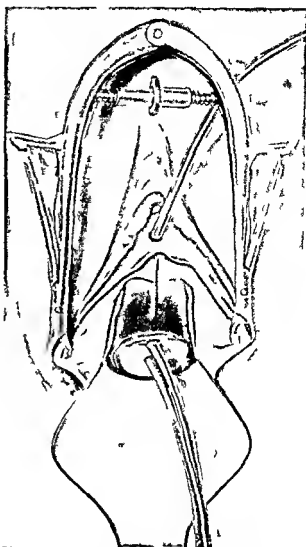


Fig. 5. Gentle traction on the catheter reveals the neck of the bladder. The line marks the incision.

2 Frank's operation. Excision of a wedge shaped piece of tissue from the vaginal and urethral walls.

3 Dudley's operation. Advancement of the urethra. The urinary meatus is displaced and is brought to lie beneath the clitoris giving the urethra a sharp angle.

4 Gersuny's operation. Torsion of the urethra.

5 Gersuny-Pawlik-Ries operation. Torsion of the urethra with advancement and tunneling.

6 Kelly's operation. Mattress suturing of the vesical neck and the sphincter vesicae with silk.

May I venture to suggest that this very able and world famed gynecologist secured his results by possibly picking up some of the fibers of the sphincter urethra in suturing the internal sphincter?

I believe the great majority of patients suffering from incontinence of urine following child

birth can be cured by apposing the torn ends of the sphincter urethra muscle. The patient is placed in the lithotomy position and a Pezzer or mushroom catheter is introduced into the bladder. Gentle traction on the catheter reveals the neck of the bladder (Fig. 5).

The anterior vaginal wall is now medially incised from a little above the urethro-vesical junction down toward the meatus and the vaginal flaps are reflected laterally.

The thickened neck of the bladder can now be felt. Directly below and stretching from side to side can be seen the deep layer of the trigone which is pearly white in color. By careful dissection far out on the sides just below this layer the torn ends of the sphincter can be isolated freed and an Allis forceps applied to each end (see Figure 6 2—in the diagram the Allis forceps is omitted). The catheter is now withdrawn. These muscle ends are usually far out and pulled upward

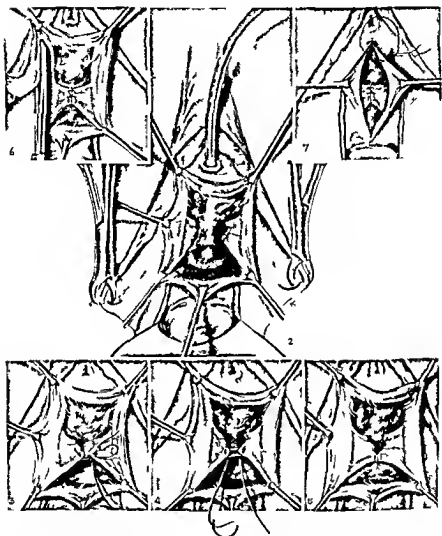


Fig 6 The t ds fth sph t th æ m scl l t d 3 d 4 h w t t h
 p ka g up th d e p l y f t h t a g n d t h t r m s l e d s t y i g the first
 t t c h o m p l t g t h p p m t d c s g t h d d t g l m c o
 7 w g p t h g u n l m s a

and outward an action which can be easily understood as the posterior and sling group of muscle fibers have been torn. The sphincter urethra muscle has no sheath the sheath of this muscle and that of the deep transversus perinei having become differentiated out to form the two layers of the trigone so that in the majority of these cases the deep layer is relaxed or partially torn.

Advantage is taken of this to include as well in my first stitch the deep layer of the trigone. This tough membrane helps to hold the muscle ends in place and prevents tearing out of the stitches until healing is complete (Fig 6 3 4 and 5). Two or three more interrupted stitches complete the approximation. The material used is chromic gut No. 0 on a small round needle.

The next step is the excision of the redundant vaginal mucosa (Fig 6 6). This obliterates the dead space helps to support the urethra and tends toward better healing (Fig 6 7). The vaginal mucosa contains a few muscle fibers from the sphincter and so is part of the sphincteric mechanism.

One of the difficulties encountered is bleeding. The hæmorrhage is always troublesome from the numerous erectile tissue spaces found around the urethra. Sometimes the artery to the clitoris or one of its branches is wounded. Free bleeding ensues which is very difficult to control as the vessel retracts far out into the trigone and is hard to find. It is most important to leave the field dry as bleeding prevents healing and makes a good harbor for infection.

A permanent catheter is now introduced. A four winged catheter with the two holding straps inside the wings removed works very well. This type of catheter collapses easily during its withdrawal and does not tear out the stitches in the muscle. It is removed in 4 days time (Fig 7).

The patient is given 5 grains urotropin thrice daily and nursed in a semi sitting position on a Gatch bed.

Of the 6 cases operated upon by this method in private and in the gynecological wards of the Toronto General Hospital there have been 5 cures. The other case failed on account of pre-

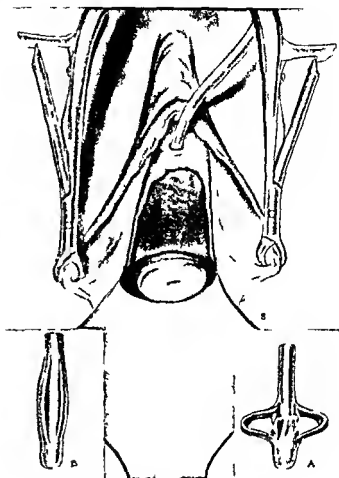


Fig 7 Retention catheter in place Views 1 and B show type of catheter used

mature separation of the stitches due to an infected hæmatoma. These cases have been observed for 3 to 1 months.

I am indebted to Professor Hendry of the department of obstetrics and gynecology and to Professor J. C. Watt of the anatomy department for their help and enthusiasm in the work and to Miss McClatchie and Miss Foster artists of no mean ability. I hope that this operation may be of some use in helping those women whose lives have been made miserable as the result of childbirth.

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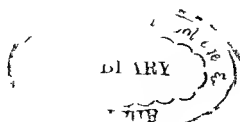




Fig 6 The to ds f the sph t r u e th æ m scl ol ted 3 d 4 how t t h p k i g p t h d e p l y of the trigo e d the t r a m s l n d 5 t y i g t h f i r s t t u t c h o m p l t i g t h e p p m a t i n d e s g t h e r e d d n t g u n a l m c 7 w i g p t h a g u n a l m c s a



Fig 2 The characteristic structure of hypernephroma such as fibrous core arrangement and fat vacuoles ($\times 150$)



Fig 3 Filling defect in upper portion of the left ureter

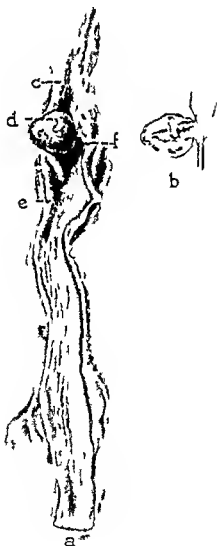


Fig 4 Specimen removed January 9, 1928, 11 months after nephrectomy c tumor d papilloma a to e normal ureter b semidiaphragmatic mid sagittal section showing the papilloma arising at the margin of the tumor with the normal ureter below

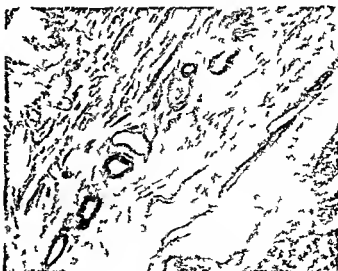


Fig 5 Section through c of Figure 4 showing the involvement of epithelial lining and submucosa by hypernephroma and the replacement of the muscularis by fibrous tissue. Adjacent to the tunica adventitia the tumor may be noted ($\times 40$)

tumors in the pelvis of the kidney and ureter without finding this type of tumor

Shattuck in 1906 reported a case in which the tumor extended half the length of the ureter. This he stated proved to be a typical hypernephroma. He did not state however whether the tumor involved the wall of the ureter. Garceau in 1909 reviewed 176 cases of hypernephroma (with clinical evidence only in most cases) and found 2 which he thought had involved the ureter. A report by Bissell in 1913 stated that he encountered unmistakable hypernephroma of the left kidney which extended into the pelvis of the kidney and down the ureter. The tumor also

HYPERNEPHROMA EXTENSION TO THE URETER¹

FREDERICK W. SCHACHT M.D. W. ET A. ILLINOIS

THE case reported here is that of a rather unusual type of hypernephroma of the left kidney in which the growth extended into the wall of the ureter.

A male aged 55 years came to the Mayo Clinic February 9, 1907, complaining of kidney trouble. He had been told of a nephroma of the right kidney in 1903. On a physical examination of the abdomen, the left kidney was found to be enlarged. The patient had a history of hematuria and backache. The patient was found to have a large, firm, rounded mass in the left flank, extending from the kidney down to the iliac crest. The mass was found to be attached to the kidney and the ureter. The patient was found to have a large, firm, rounded mass in the left flank, extending from the kidney down to the iliac crest. The mass was found to be attached to the kidney and the ureter. The patient was found to have a large, firm, rounded mass in the left flank, extending from the kidney down to the iliac crest. The mass was found to be attached to the kidney and the ureter.



For the purpose of this report, the patient's history and physical examination are summarized. The patient was found to have a large, firm, rounded mass in the left flank, extending from the kidney down to the iliac crest. The mass was found to be attached to the kidney and the ureter. The patient was found to have a large, firm, rounded mass in the left flank, extending from the kidney down to the iliac crest. The mass was found to be attached to the kidney and the ureter.

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Renal tumor of the kidney. The patient was found to have a large, firm, rounded mass in the left flank, extending from the kidney down to the iliac crest. The mass was found to be attached to the kidney and the ureter. The patient was found to have a large, firm, rounded mass in the left flank, extending from the kidney down to the iliac crest. The mass was found to be attached to the kidney and the ureter.

Nephrectomy was performed. The patient was found to have a large, firm, rounded mass in the left flank, extending from the kidney down to the iliac crest. The mass was found to be attached to the kidney and the ureter. The patient was found to have a large, firm, rounded mass in the left flank, extending from the kidney down to the iliac crest. The mass was found to be attached to the kidney and the ureter.

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Cystoscopy was performed. The patient was found to have a large, firm, rounded mass in the left flank, extending from the kidney down to the iliac crest. The mass was found to be attached to the kidney and the ureter. The patient was found to have a large, firm, rounded mass in the left flank, extending from the kidney down to the iliac crest. The mass was found to be attached to the kidney and the ureter.

Partial uretomy was performed. The patient was found to have a large, firm, rounded mass in the left flank, extending from the kidney down to the iliac crest. The mass was found to be attached to the kidney and the ureter. The patient was found to have a large, firm, rounded mass in the left flank, extending from the kidney down to the iliac crest. The mass was found to be attached to the kidney and the ureter.

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REVIEW OF CASES

Kelly in 1898 reported a case of hypernephroma of the right kidney in which a plug of neoplasm projected into the pelvis of the kidney. Ureteral involvement was not mentioned. Albar and Imbart in 1903 reviewed 83 cases of hypernephroma but did not mention extension into the ureter. They also reviewed 53 cases of

THE TECHNIQUE OF SECONDARY OPERATIONS FOR HYPERTHYROIDISM

HOWARD M. CLUTE, M.D., F.A.C.S., BOSTON

The Larynx

In our experience with hyperthyroidism of all types it has been repeatedly impressed upon us that in the presence of true hyperthyroidism the removal of an adequate amount of hyperplastic tissue from the neck will result in a cure of the disease. Failure to cure supposed hyperthyroidism by surgery is due to one of two things: first the diagnosis of hyperthyroidism as originally made was incorrect or second if the diagnosis was correct the surgery was either incomplete or inadequate.

In a study which was made of recurrent hyperthyroidism some years ago¹ it was pointed out that two types of hyperthyroidism may occur after thyroidectomy for hyperthyroidism. The first and relatively more common type is what we termed persistent hyperthyroidism. In this disease we are faced with the fact that the patient has never been cured by the original surgery. Although the metabolism comes nearly to normal for a short time after operation and there is some clinical improvement it nevertheless soon rises again to a position which is nearly as high or even higher than that preceding the original surgery and the clinical improvement rapidly disappears. In this type of patient the hyperthyroidism may truly be said to be persistent. In other words it has never been cured by the removal of sufficient thyroid tissue. In the second type of patient however a condition exists which we term recurrent hyperthyroidism. It is apparent from the study of the metabolism records of such a patient over many months or even years that an apparent cure of the disease had occurred after the primary operation. The symptoms have been absent and the metabolism normal for a long period of time such as a year or more when due to some unknown cause all the symptoms of the disease return and a true recurrence of the hyperthyroidism is discovered.

In any thyroid clinic in which careful postoperative examinations are made there will be found patients who present either persisting hyperthyroidism or recurrent hyperthyroidism and it is necessary to develop some definite plan of treatment for these cases. For some time it has been our custom to try Lugol's solution first in all

these patients. In very rare instances this will be all that is necessary to control toxicity. There are apparently certain rare instances in which following thyroidectomy for hyperthyroidism the patients present many symptoms of thyroid intoxication which are controlled completely by the daily administration of 10 drops of Lugol's solution. It is to be emphasized however that this type of case is extremely rare and that toxicity after operation is seldom permanently controlled by Lugol's solution. In these patients we consider that a period of 6 months is adequate to determine whether the postoperative toxicity is entirely controlled by Lugol's solution or whether there is a marked hyperthyroidism which demands further surgery for its cure. We do not feel that a patient is cured of hyperthyroidism when there are any clinical or metabolic evidences of toxicity and we believe that the presence of definite toxicity is sufficient reason for further thyroid surgery.

Since it will be necessary to remove further thyroid tissue from patients who have had a previous thyroidectomy it becomes essential that we establish some definite routine and technique of operation which we may follow to obtain the desired results. In any patient on whom it is necessary to remove thyroid tissue the following requirements are essential. First we must have an adequate exposure of the field. This in our experience necessitates the cutting of the prethyroid muscles. Second we must be certain that we remove sufficient thyroid tissue and that recurrence of symptoms does not take place a third time because of failure to remove an adequate amount of tissue. In the third place it is obvious that we must leave sufficient tissue to provide the patient with the necessary thyroid secretion to maintain normal metabolism. As in all thyroid operations it is of course imperative that we protect the parathyroid glands and avoid injuring the recurrent laryngeal nerve that we see the trachea in order that we may not cut into it and finally that we be constantly in a position in which we can completely control any hemorrhage that may occur from the thyroid remnant.

The technique to be described has been developed in this Clinic and is now followed with satisfaction in dealing with all patients who require

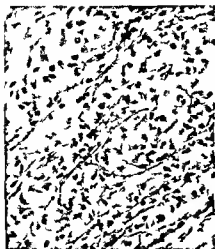


Fig 6 Section of Figure 4. The photomicrograph shows the characteristic structure of hypernephroma (x 5).

extended into the mouth of the left renal vein. He noted that the muscularis was replaced by fibrous tissue and thought it highly probable that extension took place along the mucosa and submucosa.

A review of the 85 cases of hypernephroma seen at The Mayo Clinic from 1910 to 1928 disclosed 2 cases in which this type of tumor extended into the ureter. The case reported here was the only one in which there was definite involvement of the wall of the ureter. In the other case the tumor projected into the pelvis and lumen of the ureter but histologic examination did not disclose invasion of the wall of the ureter. Extension into the pelvis of the kidney and the renal veins occurred more often. Many extensive invasions of the renal veins and vena cava have been reported by MacCallum, Oberndorfer, Keyser and Foulds and others.

Thomas and Regnier in 1924 reviewed 48 cases of tumor of the renal pelvis and ureter in which hypernephroma was observed. Papillary epithelioma of the pelvis of the kidney on the other hand is often implanted in the ureter or bladder.

So far as I have been able to learn from the literature the case presented here and the one reported by Bissell are the only cases in which there is definite evidence of involvement of the wall of the ureter by the hypernephroma.

Such tumors are usually disseminated by metastasis through the blood stream rarely by way of



Fig 7 Section of mass of Figure 4. The upper portion of the tumor lining the distal third of the ureter is completely within the portion of the epithelium (x 75).

the lymphatics by implantation into the peritoneal surface or by direct extension to adjacent tissue as in one case observed in The Mayo Clinic series in which metastatic tissue was found in the perirenal fat. It seems probable that in the case reported here a tuft of the hypernephroma was implanted on the ureteral mucosa as the line of section at the time of the nephrectomy did not show evidence of involvement.

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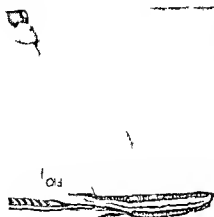


Fig. 1. The knife blade is drawn sharply through all layers of the skin and beneath the fat at right angles to the face. The skin flap is elevated by sharp dissection by blunt contact with gauze.

secondary operation for the removal of thyroid tissue. It is a striking fact that the success of many operations, particularly those in which the scar is visible after operation, is judged by certain people entirely upon the nature of the scar. For that reason, we have found that anything we may do to provide an elegant and slightly scar is most desirable. As shown in Figure 1, the first step in the operation is to excise the scar of the previous operation. We have found that considerable tissue may be safely removed without difficulty in later pulling the skin together. In excising the old scar, the knife blade is drawn exactly perpendicular to the surface of the skin and is made to go completely through the skin and fat down to the fascia of the muscles over the thyroid gland. It is quite important that the line of incision through the skin shall be distinctly at right angles to the skin so that when the two edges are approximated they shall lie snugly against one another and thus give a good final scar. The skin flap is elevated in the usual manner by dissection with the knife blade through the area between the fascia overlying the prethyroid muscles and the fat of the skin flap. Furthermore, the skin flap may be elevated very considerably by wiping it up with a piece of gauze held in the thumb and finger. A line of cleavage persists for a long time following the previous operation and the entire flap can be very quickly and very completely pulled up to the desired height after it has once been started.

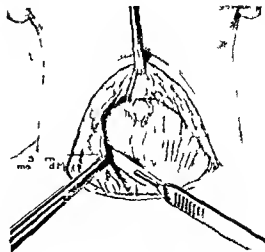


Fig. 2. The inner border of the sternomastoid muscle is directed from the surface of the prethyroid muscles.

When the skin flap is elevated it is desirable to demonstrate very clearly on each side of the neck the inner border of the sternomastoid muscle. As shown in Figure 2, the sternomastoid is retracted with forceps and the inner border is demonstrated by a careful knife dissection. In this manner the entire muscle may be pulled back and from the underlying tissue as shown in Figure 3. Deep beneath the sternomastoid will soon be seen the bulging internal jugular vein which is covered by scar tissue and by the fibers of the sternohyoid and the sternothyroid muscles at its lower end and by the omohyoid muscle in the upper part of the wound. The omohyoid muscle is an excellent landmark. It can be quite constantly demonstrated beneath the sternomastoid at the upper end of the incision. Very frequently we open only one side of the neck at a time when we are operating upon recurrent hyperthyroidism because we find in these patients as in the patients who are having their first thyroid operation that the thyroidec-tomy must at times be divided into two stages. This division of the operation is necessary not only because of the severe hyperthyroidism which may be present but also because the technical difficulties are occasionally so great that they make it inadvisable to do more than half of the operation at a time.

When the sternomastoid muscle has been retracted and the omohyoid demonstrated as it overlies the internal jugular vein, the omohyoid is lifted from the internal jugular vein and the vein is carefully dissected throughout its length in the wound. The jugular must also be completely dissected from the side of the thyroid remnants as is shown in Figures 4, 5, 6. Of great assistance

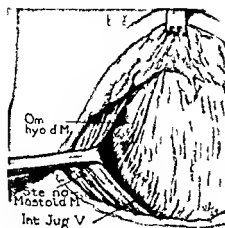


FIG. 3

Fig. 3 When the sternomastoid is pulled widely back from the prethyroid muscles the omohyoid can be clearly seen in the upper part of the wound. In the depth of the wound are visible the blue pulsating walls of the internal jugular vein which is highly covered over by the adherent muscles.

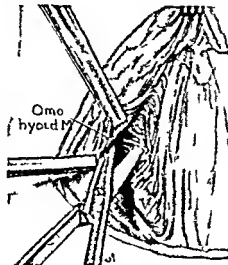


FIG. 4

Fig. 4 With the sternomastoid retracted the omohyoid is elevated and the superior and lateral surfaces of the jugular vein disclosed just beneath it.

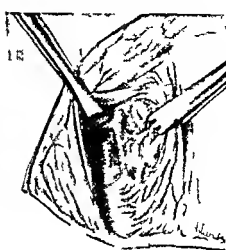


FIG. 5

Fig. 5 A double hook is inserted in the superior pole and the thyroid remnant rotated inward to facilitate dissection of the jugular vein.

In this maneuver is the rotation to the midline of the thyroid remnant by a properly placed double hook as was suggested by Dr F H Lahey some years ago. This part of the procedure is essential for the demonstration of the internal jugular vein and gives the most important landmark in the operation (Fig. 5). When we know where the internal jugular vein lies we do not injure the vein we see the lateral border of the thyroid remnant we know where the parathyroids presumably lie and we know where the recurrent laryngeal nerve is to be found. A great deal of time can justly be spent upon the adequate and careful separation of the jugular vein from the lateral surface of the thyroid remnant.

As soon as the position of the jugular vein and its relation to the lateral surface of the thyroid remnant is established we are ready to separate the prethyroid muscles from the front of the gland. With the jugular retracted from the remnant of thyroid tissue with a special thyroid retractor an Ochsner clamp is insinuated beneath the prethyroid muscles on the anterior surface of the thyroid remnant as is shown in Figure 7. When the Ochsner clamp has been pushed through to the midline of the neck two clamps are placed on the prethyroid muscles and a transverse incision is made between them as in a primary thyroidectomy. The separation of the thyroid muscles from the thyroid remnant is now relatively easy but is best done in our experience with scissor dissection of the dense adhesions between the gland and the muscles. As the clamps are

lifted from the surface of the thyroid remnant it is readily possible to free the under surface of the muscles from the gland. As the upper segment of the prethyroid muscle is raised toward the chin a place is generally reached where there has not been any previous dissection and there is a definite layer of loose areolar tissue which presents itself beneath the muscles at the superior thyroid pole. In this way the entire superior pole is very soon directly in view and is marked out very clearly. To the outside is the internal jugular vein which has been retracted from the gland remnant.

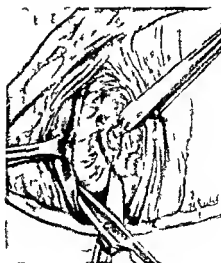


FIG. 6 The vein is here retracted with the sternomastoid the outer border of the thyroid remnant is completely visible and the prethyroid muscles are ready to be elevated from the front of the lobe.

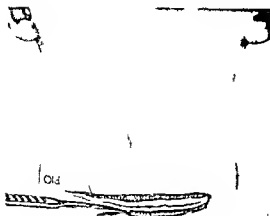


Fig. The scar is completely excised. The skin flap is drawn sharply through all layers of the skin and subcutaneous fat at right angles to the surface. The skin flap is lifted by sharp dissection by blunt retractors with the

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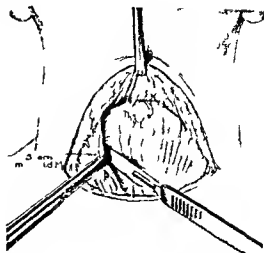


Fig. The sternomastoid muscle is retracted with forceps and the internal jugular vein is demonstrated by a careful knife dissection. In this manner the entire muscle may be pulled backward from the underlying tissue as shown in Figure 3. Deep beneath the sternomastoid will soon be seen the bulging internal jugular vein which is covered by scar tissue and by the fibers of the sternohyoid and the sternothyroid muscles at its lower end and by the omohyoid muscle in the upper part of the wound. The omohyoid muscle is an excellent landmark. It can be quite constantly demonstrated beneath the sternomastoid at the upper end of the incision. Very frequently we open only one side of the neck at a time when we are operating upon recurrent hyperthyroidism because we find in these patients as in the patients who are having their first thyroid operation that the thyroidec-tomy must at times be divided into two stages. This division of the operation is necessary not only because of the severe hyperthyroidism which may be present but also because the technical difficulties are occasionally so great that they make it inadvisable to do more than half of the operation at a time.

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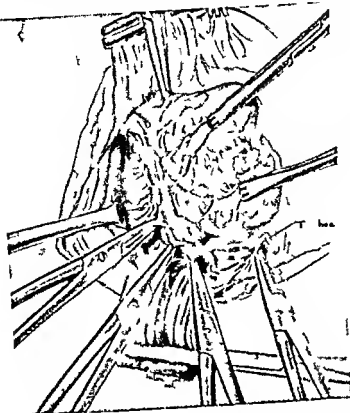


Fig 8 The entire thyroid remnant being exposed by the retraction of the jugular and the separation of the prethyroid muscles a subtotal hemithyroidectomy is done with the usual technique The trachea can be seen and protected the recurrent laryngeal nerve and the parathyroids avoided and an adequate amount of thyroid tissue can be removed

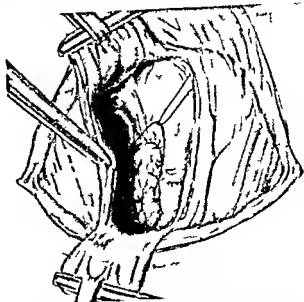


Fig 9 Folding of gland remnant to midline First suture in place to pull muscle tissue in over the remnant of thyroid tissue

ference with the healing of the scar will be in the least prominent part of the scar

In the closure of the wound the prethyroid muscles are sutured together with mattress stitches whenever it is possible. Frequently however the previous operation has made considerable scar tissue so that mattress sutures become somewhat difficult to apply and then ordinary interrupted stitches must be used for closing these muscles. The platysma muscle is not sutured for we have found that this is not necessary if the skin is closed accurately with skin clips. One half of the skin clips are removed from the wound on the third day after operation and on the fourth day all the remaining clips are removed. This gives the smallest scar compatible with safety.

The most essential points in secondary operations for recurrent or persistent hyperthyroidism are adequate exposure by cutting the prethyroid muscles and demonstration and dissection of the internal jugular vein and common carotid artery from the thyroid remnant. With these two points accomplished the procedure takes on the simplicity of the original subtotal thyroidectomy.

shown in Figure 9. Most of the oozing after thyroidectomy in recurrent hyperthyroidism comes from just beneath the skin flap; the actual operative field itself being almost always completely dry before it is left, so that drainage to the deep layers is not necessary. If however the gland surface oozes sufficiently to prevent control by folding or by placing raw muscle over it, we then insert a cigarette drain and place the gauze over the oozing surface. If a cigarette drain is used however, we prefer that the drain emerge at the outer angle of the wound and that it enter the deep layers beneath the lateral incision in the prethyroid muscles. This gives drainage which is aided by gravity and provides that any inter-

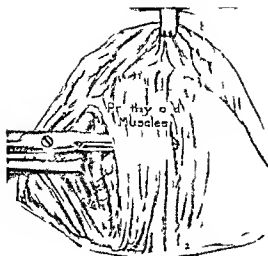


Fig 7 The prethyroid muscles are elevated by setting an Ochsner clamp beneath the muscle and cutting them transversely. Each portion of muscle is then dissected down to the prethyroid muscle. The prethyroid muscle is then dissected down to the sternum.

Above are the prethyroid muscles which have just been elevated. To the inside lies the laryngeal cartilage and it is almost always possible to visualize the entire superior thyroid pole of the remnant with its blood supply. The muscle overlying the lower portion of the thyroid remnant must now be dissected downward. Its edge is held by an Ochsner clamp and its inferior surface is carefully cut away from the thyroid remnant. It is important that this muscle shall be dissected well down the neck until one is able to feel and see its attachment to the inner surface of the sternum. By the adequate section of the prethyroid muscles one may be certain he has a complete exposure of all the thyroid remnants. After we have removed very large thyroid remnants from the upper portion of the thyroid gland region we have repeatedly noted that there is still a large piece of thyroid tissue to be found at the lower pole well down at the sternal notch. Unless the prethyroid muscles are dissected downward from the gland and freed from the vein it will not be possible to see this area. Furthermore as these muscles are dissected downward to their attachment on the inside of the sternum it is noted that there is considerable loose areolar tissue in the midline of the neck which overlies the trachea. When this areolar tissue is visible the trachea can be felt and in many instances can be seen in the midline of the neck at the sternal notch.

It is to be seen from what has already been said that a large part of thyroidectomy in recurrent

hyperthyroidism is related to the exposure of the thyroid remnants. Unless a great deal of careful attention is paid to the dissection of the jugular from the side of the remnant and to the demonstration of the trachea in the midline and of the superior pole above a safe removal of the remnant of thyroid tissue will not be possible. On the other hand it is equally true that if all these structures are carefully demonstrated before the removal of any thyroid tissue is attempted that an adequate amount of thyroid tissue can be readily removed in the manner of the usual primary operation. As is shown in Figure 8 double hooks are placed upon the thyroid remnant just as in a primary operation. At the superior pole the vessels are caught and clamped. At the side of the thyroid remnants the vein is retracted and sharp clamps are pushed into the thyroid tissues. Notice in Figure 8 that the trachea is very clearly demonstrated in the midline by the deep reflection of the lower segment of muscle. Notice that a snap is in such a position over the front of the trachea that it separates the isthmus of the gland from the trachea and yet is placed so that it will not endanger any of the tracheal rings. It is obvious from Figure 8 that all the technique of primary thyroidectomy can be readily followed. An adequate piece of thyroid tissue can be left behind and sufficient thyroid tissue can be removed. Hemorrhage can be completely and readily controlled by the folding over of the thyroid remnant after the major portion has been removed or by the dissection and ligation of the inferior thyroid artery beneath the internal jugular vein and carotid artery at the side of the thyroid remnant. The parathyroid glands which generally lie on the outer surface of the gland on the lateral and inferior surface of the lobe are protected by leaving tissue in this area whether or not they are visualized. The recurrent laryngeal nerve is protected as in the usual thyroidectomy by avoiding the area in which it runs.

The closure of the wound after the removal of thyroid remnants is carried out as in a primary thyroidectomy. The edge of the thyroid remnant can be folded over to the midline as shown in Figure 9. Note that the stitches are so placed that they bring the edge up to the thyroid cartilage. It is desirable to avoid folding gland tissue over to the trachea since it has been our experience that this may put sufficient pressure on the trachea to obstruct it. The uncut lateral extension of the sternothyroid muscle is extremely useful to fold in over the remnants of thyroid tissue to obliterate the dead space as well as to control any ooze which is still present. This procedure is

viscera, one may find the pyloric end of the stomach in the lower abdomen, movable kidneys prolapse of the spleen, and ptosis of various abdominal viscera, without any symptoms whatever

As a matter of fact people vary as much in the position of their internal organs as they do in the position of their external organs. If a blond man 6 feet tall came to us and said that he wanted to be a brunet 5 feet 10 inches tall we should think that he was mentally deranged, yet series of operations have been undertaken to restore organs to a supposedly normal position under the general theory that there was such a fixed normal position.

It is in this class of case that the shrewd experienced practitioner must separate those material things which have a relationship to the complaint from those immaterial things which after all concern the emotional and psychic side of the patient's life. This problem most often arises with female patients who are social misfits. Some of them can be helped but with others the condition is due to circumstances over which neither the patient nor the physician has control. Such patients may go to the hospital for an operation and improve greatly as the result of rest in bed and relief from responsibilities. On return home after a surgical vacation they are looked after more carefully and perhaps have domestic help temporarily only to relapse when the original conditions of life are re-established. It is in this type of case that the cults have their great field.

The wise medical practitioner the family friend is the man for the job although we do not give to his method of handling the case the high sounding term of psychology. And in all conditions the nervous and mental reactions of the patient to the disease must be analyzed and carefully evaluated but they must not be overestimated.

W J MAYO

THE POTENTIAL MALIGNANCY OF WARTS AND MOLES

NO VARIETY of malignancy is more easily prevented than the type which has its origin in warts and moles. The predisposing lesions are superficial and therefore always evident. The factor of irritation the one definitely established factor in the etiology of malignancy is inevitable is there for all to see in these tiny growths which are always subject to the repeated insults minor though they be of scratching of the friction of clothing of the trauma of towel or comb or brush. The prophylaxis complete excision of the causative lesion is simple and absolutely sure. Yet people continue to die of the malignancy which develops from these lesions or must be subjected to extensive and mutilating operations for its cure if they are fortunate enough to escape with their lives. Surely such a situation is disheartening proof of the inadequacy of our campaign for the control of cancer.

The majority of warts and moles are potentially benign lesions and tend to retain their benign characteristics regardless of the trauma to which they are subjected. But a small group is potentially malignant and under repeated insults not only exhibits its malignant properties but sometimes proves very rapidly fatal. Twenty five cases of this sort with 10 deaths were reported in 1904 by W W Keen dean of American surgeons in a paper read before the American Medical Association and isolated instances of the same sort have been reported ever since the latest a peculiarly striking case because of the rapidly fatal outcome by Kurtz of Philadelphia.¹ I have personally seen 5 such cases within the past 6 years all of them originating from pigmented moles on the sole

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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JULY 1931

THE RELATION OF PSYCHIC MANIFESTATIONS TO CLINICAL INVESTIGATION

PSYCHOLOGY is a word widely used and often abused. In medicine applied psychology has its place as part of clinical investigation and is most valuable when there has been a previous acquaintance with the patient but in diagnosis it must be taken in conjunction with the condition of the patient. Let us not forget that the signs and symptoms of the patient's disorder meaning thereby the things that we can detect with our special senses are the most valuable because they do not depend on the emotions of the patient.

Under proper conditions applied by one who has had good medical training psychological data have value but the term psychology covers much loose thinking by men who have had little or no clinical training.

To ask a series of questions and then analyze the answers is often a hopeless task unless there is in addition material evidence of dis-

ease. So frequently we see the psychologist trying to evaluate an illness by an analysis of immaterial conversations held with the patient as one would examine the blood or would seek other physical evidence—an attempt to give material consideration to immaterial phenomena.

The brain of man is an eye brain. The development of the gray matter of the hemispheres was coincident with the growth of vision. Always do we need to keep in mind in diagnostic evaluation whether the evidences of disorder are such as can be detected by our special senses or whether they are symptomatic complaints or psychic phenomena. Careful evaluation is most essential for what we ordinarily call the neurasthenic patient.

Great care is necessary before advising operation in a wide range of disorders especially those conditions in the abdomen which concern the position of the viscera. Many operations which have had no demonstrable relation to the patient's condition have been performed for so called ptosis of organs and various doubtful abdominal disorders usually with temporary relief which is followed by a return of the symptoms more operations and more relief until the sick habit has become confirmed.

There seems to be a conviction in the minds of many that the inside anatomy of the human body within a small range of deviation has a like configuration in all instances yet we know that the position of the abdominal viscera varies greatly in different individuals. In the routine of examining patients for various conditions which do not concern the abdominal

of the foot all of them exhibiting a most malignant variety of sarcomatous change with widespread metastases and all of them seen only when the malignant process was so far advanced that surgery of any sort was impossible

The type of mole which originates in hypertrophy of the papillary layer of the skin tends to become carcinomatous but excision even when malignant changes have occurred is frequently curative. On the other hand the type of pigmented mole which exhibits enlarged and proliferating blood vessels can develop not only this variety of malignancy but also sarcomatous changes of a peculiarly uncontrollable and rapidly fatal character. The disease exhibits widespread metastases and multiple recurrences and surgery is not only futile but actually seems to hasten the end.

We need to remind the public constantly and we need to remind ourselves almost as often that a mole to quote Keen may be the match which starts a conflagration. Some warts and moles are potentially be-

nign some are potentially malignant. Some subjects who exhibit them are cancer susceptible others are cancer immune. But we have no way of classifying either the lesions or the patients and the only rational course of action therefore is to remove all warts and moles before they have developed their possibilities for harm which they can do on any portion of the body and at any period of life—the fact that they have existed innocuously for years is no guarantee that they will remain harmless. It is positively not safe to delay removal until they have begun to enlarge or to manifest symptoms. Then the mischief is already done the potentially malignant characteristics have become actually malignant and attempts at removal frequently serve only further to disseminate the disease.

Removal before such a development on the other hand is a simple procedure by any method and particularly simple by electro-surgery and in practically 100 per cent of all cases it is a procedure which terminates the menace forever.

URBAN MAES



EDUARD BOECKMANN

1849-1927

MASTER SURGEONS OF AMERICA

EDUARD BOECKMANN

IN the early days of medicine among the men who were educated abroad and who brought their learning into the Northwest Dr Boeckmann occupied a very high place, not only as a practitioner of surgery but as a teacher of the profession. We learned to know and to love him for his sterling qualities of mind and heart. It is to such men as Dr Boeckmann and the late Christian Fenger that the profession owes a great debt and I have requested that this short biography of Dr Boeckmann be written that those of us who knew him may testify to his scientific leadership and the younger generation may not forget one of the old masters.

W J MA10

DR EDUARD BOECKMANN widely known ophthalmologist and general surgeon died at Dellwood White Bear Lake Minnesota on August 8 1927 in his seventy ninth year. He was one of the prominent medical men of the Northwest and his notable contributions to medicine and surgery with his unselfish devotion to his profession were a source of inspiration to his many friends and colleagues.

Dr Boeckmann was born in Totn Norway March 25, 1849 the youngest son of Daniel Peter Boeckmann an officer in the Norwegian Army and Eduardina Dreier Boeckmann. He received his early education at private schools in Christiania and entered the University in 1868. He was given his degree of Doctor of Medicine *cum laude*, in 1874. While a student at the University he received the Skjeldrup medal for research work on the anatomy physiology and pathology of the tonsils. After graduating from the University Dr Boeckmann was appointed assistant at the Lungegaard's Hospital for Lepers in Bergen and the following year physician in charge at St Jorgen's Hospital in the same city.

In 1882 he was given his Master's Degree in medicine by his alma mater for his thesis on "Keratitis Xerotica." About this time he made several trips to Copenhagen and Utrecht studying ophthalmology with Grut Hansen Snellen, and Donders. After two visits to America in 1883 and 1885 (at which time he practiced his profession in Chicago and in Minnesota) he brought his family in 1887 and settled in St. Paul where he lived for the remainder of his life.

He was a pioneer in scientific medicine and laboratory work. In the late eighties he brought to St. Paul his friend and former associate Dr. G. A. Hansen, the discoverer of the bacillus of leprosy. Dr. Hansen worked in his office for over a year. Laboratory investigations in pathology and bacteriology with the aid of a microscope were at that time almost unknown to many members of the medical profession in the Northwest, and it may be of interest to note that work of this character was sometimes looked upon with suspicion.

Dr. Boeckmann's early contributions to medical literature were largely concerned with ophthalmology and were written in his native language. Among these were papers on "The Leprosy of the Eye," his own pterygium operation, and the "Treatment of Pannus by Penectomy." During the years that followed his coming to St. Paul, he wrote many papers on antiseptic aseptic methods of sterilization, etc. At that time he invented and patented a steam sterilizer which was extensively used. One of his most important achievements was the perfecting of a method for preparing pyoktanin catgut for ligatures. He generously turned over the manufacture of this product to the Ramsey County Medical Society, in which he was deeply interested, and the profits from this industry constitute the major part of the now considerable fund which is known as the

Boeckmann Library Building Fund. The Ramsey County Medical Society also received from Dr. Boeckmann many contributions from his own library, and he was a generous supporter and adviser of the society for many years. He was one of the founders of the *St. Paul Medical Journal*, which after 17 years of usefulness was turned over to the Minnesota State Medical Association and continued as *Minnesota Medicine*. It was to the former journal that Dr. Boeckmann contributed papers on "Transverse Incision in Abdominal Surgery," "Chronic Pancreatitis," and on many other subjects.

Dr. Boeckmann practiced medicine in all its branches with proficiency and skill, and contributed many original ideas and procedures to the art and science of medicine. He often made the statement that he was a country doctor practicing in the city. As his patients came from the entire Northwest, naturally many of them were of Norwegian extraction. His clientele was large and various, and as he made a practice of staying at his office until the last patient was seen, it was frequently late at night before he finished. Owing to his vigorous constitution and strength, he was able to stand this intense physical and mental strain.

As an ophthalmologist, he was a recognized authority as a consultant, for not only was he familiar with the thought and procedure of yesterday, but was thoroughly conversant with the ideas and practice of the present. Though conservative, he was ready to accept new methods if his experience indicated need of such innovations. Dr. Boeckmann held European authority somewhat superior to American, but weighed all opinions against his own experience, which was based on an enormous number of patients and a long period of practice. His

opinion was recognized as final by his confreres without comment ' Dr Boeckmann's usually ended any argument He was most generous in giving counsel to his colleagues without compensation Many younger men received much needed guidance from him and this advice was given in a gracious and agreeable spirit He was modest in deportment and undesirous of publicity Neither envy, malice, nor covetousness had a place in his makeup He listened kindly and attentively to others and gave his own opinion in such a way as to cause no humiliation or rancour Dr Boeckmann was liberal in his views of life and society dispensed charity willingly, and was generous in his estimation of others he was not given to unkindly criticism either professionally or otherwise Calm and deliberate in all his actions and speech he nevertheless was occasionally annoyed by what might be considered trifles by others He particularly resented anything derogatory to the land of his birth even if said in jest though his sense of humor was acute He delighted in entertaining his friends and colleagues

Dr Boeckmann collected a gift of money among Norwegian Americans and others for the University of Christiania in celebration of its one hundredth anniversary The same year he was given a degree of Doctor of Philosophy by the University and was made a commander of the Order of St Olaf by the King of Norway During the Spanish American War he served as Major in the Medical Corps of the United States Army in charge of a division hospital He was one of the founders of the Bethesda and St Paul Hospitals The last years of his life he was a member of the staff of the Charles T Miller Hospital

Dr Boeckmann was married in 1875 to Miss Anna Sophia Dorothea Gill His wife and four children three daughters and one son survive him Quoting from the writing of a friend in *Minnesota Medicine* of September 1927

Nature had richly endowed him That robust constitution permitted long hours of labor with little rest From his early years to advanced age he worked long into the night Frequently in the early morning hours he could be found studying scientific literature or in the preparation of medical works Gifted with a brilliant mind his faculty for clear and consecutive thought made him the great physician that he was His originality tenacity of purpose dogged perseverance and independence of thought resulted in attainments for which he was widely known He was possessed with an indomitable will and pride that were his heritage His moral courage should be the envy of all men for he feared no one His intimates were few his friendship enduring In defense of a friend he would stand alone if need be for his knowledge of human frailties made him the magnanimous spirit that knows no creed

His sincerity none will question he was honest to a fault Simple in manner and frank in expression he had a rightful repugnance for ostentation and false show He repelled the rich and invited the poor He appraised the character and not the wealth

Charity was his religion What greater virtue hath any man!

EGIL BOECKMANN

He was a pioneer in scientific medicine and laboratory work. In the late eighties he brought to St. Paul his friend and former associate Dr. G. A. Hansen, the discoverer of the bacillus of leprosy. Dr. Hansen worked in his office for over a year. Laboratory investigations in pathology and bacteriology with the aid of a microscope were at that time almost unknown to many members of the medical profession in the Northwest, and it may be of interest to note that work of this character was sometimes looked upon with suspicion.

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HENRI DE MONDEVILL

D'après le manuscrit de l'an 630 de la Bibl. Nat. de Paris écrit en l'an 1314
du 21 de l'année

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Front

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

ALFRED BROWN M.D. F.A.C.S. OMAHA

THE SURGERY OF HENRI DE MONDEVILLE

It is truly remarkable that the works of two of the greatest surgeons of the thirteenth century should have escaped the observation of both the medical men and the great printers of the Renaissance especially as one of these surgeons Henri de Mondeville was the first native Frenchman to write a surgery.

It may be that the reason was that de Mondeville's work was never completed for he died before he accomplished the task he had set himself and it may be that he was overshadowed by his student and successor Guy de Chauliac who treated de Mondeville about as he treated everyone else. One grows rather impatient at de Chauliac's constant dogmatism on nearly all the surgeons of his time. Regarding de Mondeville he says Henri de Hermondaville at Paris commenced a very notable treatise in which he attempted to make a marriage between Theodoric and Lanfrancus but being prevented by death he did not finish the treatise. Reading a note of this kind the contemporary student would naturally pass the work by as only a fragment and of little importance and this is evidently what happened. It was not until 1897 that Dr. Julius Leopold Pagel published the Latin text of de Mondeville's *Surgey* and a year later Dr. E. A. Cause with the collaboration of Dr. Saint Lager and F. Chavannes published his entire *Surgey* translated into French. This revealed that in the treatment of wounds at least de Mondeville's ideas were far too advanced for his contemporaries to understand and it was not until nearly three hundred years later that another surgeon of France, Ambroise Paré was to rediscover them and put them in practice. In fact de Mondeville being a better educated man than Paré and thus better able to reason logically was even beyond Paré in his wound treatment. He was sucky in his later years however and evidently did not have the requisite energy to insist upon his ideas and his more aggressive student de Chauliac reverting to the ideas of the ancients popularized them so that the effect of de Mondeville's great teaching was lost. Both he and his work were forgotten.

Henri de Mondeville was born in Normandy some time during the early part of the latter half of the thirteenth century. Where he studied medicine is not known but as he was a graduate in medicine

and not one of the ignorant lay surgeons it is fair to assume that he studied at Montpellier which was at that time the greatest school in France. Here he became a cleric and attained the rank of Master in Medicine.

Later he went to Italy and there studied surgery under the Italian surgeons and became greatly impressed by the ideas of Hugo de Lucca which were being taught by his son Theodoric. In 1301 de Mondeville is first mentioned as physician to the King Philip the Fair so he must have gained considerable reputation by that time. He accompanied the armies on their campaigns and there had the opportunity to try out the ideas of wound treatment he had learned from Theodoric in Italy. Evidently the results pleased him. He began to study wound healing and gradually evolved definite principles which later he incorporated in his book. Following the death of Philip the Fair in 1314 he became surgeon to his successor Louis the Quarreler but by this time was probably relieved from the duty of accompanying the army in its journeys and wars. He apparently preferred teaching. He was teaching at Montpellier in 1303 and began to teach at the University of Paris in 1306. During some of this period he was evidently working on his treatise for he says that in 1312 in Paris he read the first two chapters of his *Surgey* before a large and noble assembly of medical students and other distinguished persons.

About 1316 his health began to fail and he tells us that he is fearful that he will not be able to finish his work. He made a brave fight but his prognosis proved correct and after finishing most of the *Surgey* he died probably about 1320 leaving some of the chapters incomplete.

De Mondeville's great work was in the treatment of wounds. The current method was to enlarge wounds by tearing them and then filling them with tents putting on remedies to promote suppuration and dressing them frequently. Along with this the patients were starved until with the infection and starvation the condition was pitiful. The ancients believed also that wounds should be healed slowly and under such treatment they must have been correct in their assumption. This method did not at all appeal to de Mondeville and he is most scornful of it. He says: "By this treatment more people die than are cured and the treatment of those who recover is prolonged up to three months and the patient is always an invalid."

REVIEWS OF NEW BOOKS

THE new well illustrated text and reference book on *Diseases of the Skin* by Andrews¹ is worthy of a place in the study of the student or practitioner interested in dermatology and syphilology. It is up-to-date and distinctly practical.

The book is divided into 36 chapters logically and uniquely arranged as follows: anatomy and physiology; etiology and pathology; symptomatology and general diagnosis; classification and terminology; principles of treatment: roentgen ray therapy; suppurative lesions; radium therapy; ultraviolet light; surgical diathermy; dermatoses due to physical causes; dermatoses due to local chemical irritants; dermatitis medicamentosa; erythema and urticaria; pruritus and cutaneous neuroses; eczema and allied conditions; psoriasis; lichen planus; vesicular and bullous affections; acne vulgaris; miscellaneous pyogenic infectious diseases due to fungi; tuberculosis; cutaneous diseases due to bacilli; syphilis; diseases due to animal parasites; trophic disturbances; diseases of congenital origin; benign neoplasms; malignant neoplasms; the lymphoblastomas; diseases of the skin appendages; diseases of the mucous membranes; affections of the cutaneous blood vessels; anomalies of pigmentation; and tropical diseases of the skin.

The author's descriptions are for the most part concise and clear. He has incorporated in every chapter his own experience and opinion. He has however given freely of credit where credit is due especially as evidenced by the bibliography at the end of each chapter, this containing references to most of the pertinent literature. Although brevity is a virtue in places this has been practiced to such an extent as to make descriptions less lucid. Unfortunately as is true with most dermatological textbooks the histopathology has been somewhat slighted.

CLARA W. FISHER

IN his book² entitled *Cancer of the Lung and Other Intrathoracic Tumours* Maurice Davidson has given us a timely volume justified by the phenomenal post war increase in the incidence of primary neoplasms of the lungs and bronchi. Formerly met with only rarely these lesions now make up from 5 to 10 per cent of all malignancies. Because of this fact and because in its different types and stages cancer of the lung can simulate practically every other chronic pulmonary affection this excellent exposition of the subject fills a definite place in English medical literature. While the book is a practical text designed to make readily available the results of the extensive statistical pathological and clinical

work which has been done on the subject it has an ample bibliography and should be valuable to the specialist in pulmonary diseases as well as to the general diagnostician.

The chapter on diagnosis is especially good. The author stresses the necessity of considering it in all cases and of using every available aid in establishing the diagnosis. Among the methods besides the roentgenogram, bronchography, bronchoscopy, diagnostic pneumothorax, thoracoscopy, and exploratory operation.

The section on intrathoracic tumors other than cancer is too brief to be of great value and might well have been either omitted or improved.

JEROME HEAD

THE laboratory guide by Nicholson³ is intended as a vademecum for the practitioner who is isolated from university centers. Nevertheless it will be of interest to everyone. It contains a large amount of practical data presented in easily accessible form. One is impressed with a few rather unusual procedures intended to be short cuts for the busy practitioner. The section on blood contains a good color plate of cells including vital stained reticulocytes. The Price Jones curve is emphasized and a homemade halometer is shown. The section on blood chemistry includes directions for performing the usual determinations by simplified methods. There is a good section on biological reactions of the blood. In the bacteriological section the typing of pneumonia by the urine method is given. The Fremont Smith and Ayer table of differential diagnosis of cerebrospinal fluid findings is included. There are numerous photographs of urinary sediments. Basal metabolism technique is described. These selected examples indicate that this book is up to date and useful. It will be worth while to keep it at hand and use it.

PAUL STARR

IN search of new anesthetic methods surgeons are confronted day after day with new drugs and new methods of administration. These methods can survive only if prolonged clinical trial proves their advantages over well recognized methods of intubation and local anesthesia. In a most timely contribution the Surgical Clinic in Kiel⁴ presents a six hundred page monograph on avertin (tribromomethyl alcohol). After so many enthusiastic or wholly deprecating articles the impartial critical attitude of this book makes it a real contribution in the history of anesthesia. The chemistry and pharmacology of avertin, the premedication and dosage together with various methods of adminis-

¹ D. E. ANDREWS: THE SKIN. A TEXTBOOK FOR PRACTITIONER AND STUDENT. By George Clinton Andrews, M.D., Philadelphia and London: W. B. Saunders Company, 1935.

² CANCER OF THE LUNG AND OTHER INTRATHORACIC TUMORS. By Maurice Davidson, M.D., D.Ch. (Ox.), F.R.C.P. (Lond.). With a foreword by Arthur J. Hall, M.D., D.Sc., F.R.C.P. New York: W. H. Wood & Company, 1935.

³ LAB. MEDICINE. By David Nicholson, M.D., Philadelphia: Lea & Febiger, 1935.

⁴ DIE AVERTIN-ANESTHESIE. 2. Aufl. Dr. Christiane. By Prof. Dr. W. A. Schleich, Dr. K. Specht, Dr. D. F. T. Mann, Berlin: Julius Springer, 1935.

the side of the pelvis and rightly stresses the avoidance of tension upon the remaining parts and leaving them pliable—the danger of prolapse of the cervix or vaginal vault has been, he believes, overestimated. His emphasis upon this point is one of the most valuable lessons in the book.

Under the cellulitis group have been placed all non gonorrhoeal infections—quite a number of them including the puerperal. A very clear picture of them is thus presented.

There are excellent short chapters on genital tuberculosis, syphilis and the non specific (commonly) venereal infections.

The second section deals with tumors of the uterus. His estimate of the comparative value of radium and operation in the treatment of uterine fibroids—that in the main radium should be used only for women near the menopause with small bleeding fibroids and when the health of the patient contra indicates operation—seems eminently sound. Again he urges adequate support without rigidity in dealing with the vaginal vault or cervix in the concluding stages of a hysterectomy.

His chapter on cancer of the cervix is one of the best in the book. He stresses thorough search which may include bissection of the cervix in suspected cases—cancer of the endocervix may easily be overlooked. Bleeding is the paramount symptom in early cancer of the uterus and must be satisfactorily explained before ruling out this serious disease. The author uses radium combined often with surgical diathermy except in cancer of the fundus in which instance hysterectomy is preferable.

The third section devoted to tumors of the ovary is a simple practical treatment of this subject devoted conspicuously to the differential clinical diagnosis and the operative management.

The fourth section places before the reader a clear picture of the injuries created by childbirth by following the course of the child from the beginning to the end of labor and pointing out that we may not properly think of such injuries merely in terms of displacement of the uterus and a weakening of its supports but regard all the tissues involved in the process. Examination should be directed to all injuries rather than to a few of the more commonly recognized ones. In repair he stresses the value of reconstruction of the pelvic tissues without undue tension fixation or rigidity. In the correction of the retrodisplacements the author's usual procedure is silk suture of the uterosacral ligaments together with the Baldy Webster operation and advancement of the bladder peritoneum upon the fundus. In selected cases an angle worm reefer of the round ligaments less often a modified Gilliam or Simpson operation is used.

There is an excellent detailed illustrated account of the operation for prolapse, urethrocele and cystocele of the author's operations for perineal lacerations and rectocele.

In the fifth section are short chapters giving the path of the prevalent ideas on dysmenorrhoea, uterine

haemorrhage, amenorrhoea, the menopause, sterility and the endocrine disturbances from the gynecological aspect.

The sixth section gives an excellent resumé of Sampson's work on endometriosis.

Those interested in the now more than ever discussed question of chronic leucorrhoea will be interested in the background for study given in the author's short chapter on the subject. In his own investigations of a particular case the husband is interviewed and examined in all instances in which the leucorrhoea is of an infectious nature.

Genital fistulae are discussed briefly, also backache, the disturbances of the pelvic veins, the physiology and pathology of the endometrium and lesions of the cervix. Gynecologists are indebted to Dr. Curtis for calling attention to the frequent occurrence of cervical stricture and the rôle that it plays in pelvic pathology. Just as we have learned to recognize that haemorrhage after menopause is almost always diagnostic of uterine cancer, we may with equal assurance state that the otherwise inexplicable sudden appearance of profuse vaginal discharge in a woman well beyond the menopause is pathognomonic evidence of cervical stricture.

The volume is comparatively short, the bibliography has been well selected, the English clear and concise and the book as a whole well worthy of this master gynecologist. To say that Tom Jones and Mary Dixon have furnished the illustrations means that nothing finer could be produced.

RICHARD R. SMITH

THE work on *Dosage Tables for Roentgen Therapy* is translated from the second German edition with the object of assisting the practical radiologist to estimate dosages without being obliged to go through the tedious physical mensuration and calculations necessary for the academically accurate measurements demanded by the physicist. The practical results obtainable by the dosage tables given in this little work are perfectly reliable within reasonable limits. Of course these dosages relate to the physical quantities. As the author explains, whatever stress is placed on biological factors, we must always recall that the biological effect of the X-ray can be ascertained only quantitatively by using physical constants. These tables have proved very useful to all radiologists engaged in radiotherapy.

JAMES T. CASE

THOUGH the literature on solid tumors of the ovaries is very extensive, there has been since 1910 no monographic treatise on this subject except perhaps in the most recent large handbooks such as *Biology and Pathology of Woman* by Halban and Setz. De Mora's book² therefore is a highly acceptable offering. It is based on 24 cases which

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tration the combination with other anesthetics the concentration of the solution and its absorption the course of a normal anesthesia the untoward effects during and after narcosis and their prevention the death reports and their critical analysis and finally the present indications and contra indications of this method are the most important chapters

What is perhaps most instructive to the American reader are the methods of arriving at a proper dosage the proper organization of the personnel for such an anesthetic and the interesting contributions to the absorption of avertin from the lower end of the colon Professor Anschuetz and his collaborators do not know whether this method is going to survive or not whether it is going to be limited to certain operations or whether it will be discarded as has the scopolamine twilight sleep Nevertheless they have done more than anybody else so far to stabilize the method Their statistics and conclusions are based on the analysis of over three hundred thousand anesthetics The bibliography is complete up to the early months of 1930 The style is unusually clear and concise The book is a very important contribution to surgical progress

G DE TARATS

THE preface of Bentlin's *Gynecological Diagnosis* opens with a veiled apology Such a beginning is psychologically unsound Moreover the author requires no justification To be sure the medical student would not read a special work of 350 large pages nor would the general practitioner acquire it save the exceptional one who has the urge toward self improvement But there is a very definite need for just such a book for the younger generation of gynecologists those who are still serving their apprenticeship or have only recently started their own practice and even older and more experienced men will find much of value and interest in this work of a careful and judicious observer

A subject of this sort hardly lends itself to detailed reviewing yet one cannot refrain from pointing out some of the statements which seem particularly new or praiseworthy While the genital findings are obviously the starting point in making a diagnosis the interrelations between the reproductive organs and the entire organism are so numerous and significant that the whole personality of the patient assumes great importance Hasty diagnosis may lead to faulty indications for therapy and often more than one examination is needed to clear up the situation If we stop to consider how often operations are performed on the strength of impression rather than of facts we must needs feel in agreement with the author We must also underscore his warning against the traditional use of the uterine sound as a diagnostic aid and agree with him that the practical value of salpingography is inferior to that of tubal insufflation The chapter

on the diagnosis of beginning general peritonitis which is as difficult as it is easy in advanced peritonitis was to me of particular interest Among the various diagnostic signs and symptoms described the author lays particular stress on the dryness of the tongue if the edges of the tongue are dry one hardly needs to seek further One might however question the propriety of puncturing the abdominal wall a procedure which he recommends though he is aware of the objections that have been made As a final means of arriving at a diagnosis he proposes exploratory laparotomy It is an heroic step but it is better to open the abdomen once unnecessarily rather than to have caused irreparable harm by undue delay

Wholly admirable and acceptable are the discussions on the differential diagnosis between hydrosalpinx and pyosalpinx and between tubal pregnancy and other affections of the adnexa A very good chapter too is the one on diagnosis during operation In fact the book is far from being a dry enumeration of signs and symptoms It is written in a pleasing style simple enough to render its study easy to American readers enlivened by many very brief pertinent case reports supplied with x-ray charts and illustrations and above all beautified by 48 plates of truly excellent pictures in natural colors The publishers deserve commendation for bringing out this book with its attractive make up at a very reasonable cost

GEORGE GELLERMAN

NOT since Howard Kelly published his first gynecology has a book dealing with this specialty appeared which so closely reflects the viewpoint and the practice of its author as does Curtis' *Textbook of Gynecology* His personal opinions and ideas based upon a rich clinical experience and his own extensive and painstaking investigations and his judicious comment upon what has been done by others may be found all through the volume and give great value to a work which may well be considered an outstanding contribution to the gynecology of the period The student will find here a very dependable textbook dealing with most of the problems encountered in practice today To the experienced gynecologist it is a monograph which he will read with absorbing interest since it comes from a co-worker whose opinions are most highly esteemed and respected

The first section is devoted to the infections Under gonorrhea the author emphasizes the harmfulness as a rule of active treatment of fresh infections the self limited nature of salpingitis the factor of reinfection as a cause of repeated attacks and conservation in dealing with such lesions Operations should be done largely to remove the pernicious results of such infections rather than the infect on itself At operation whether a total or partial hysterectomy is done in addition to a salpingectomy the author places the ovaries in a

have been studied very thoroughly both from the pathological and clinical aspects. Anatomically the tumors are divided into four categories: connective tissue (fibroma, sarcoma, endothelioma), epithelial (carcinoma, chorio epithelioma, folliculoma, wolffian ducts tumors, etc.), metastatic (Krukenberg tumor, secondary carcinoma), and heterotopic (teratoma, struma, hypernephroma). This first part of the book contains 15 plates with pictures of the gross specimens and photomicrographs.

The second part deals with the symptoms, complications, diagnosis and differential diagnosis, surgical and radiological treatment, the operative mortality and the final results. Throughout the book a very conscientious study of the literature of the world is in evidence. The diagnosis of a solid tumor of the ovary can be made without much difficulty in most cases, but the exact nature of such a tumor can as a rule be determined only at operation or on histological examination. Of the author's 24 patients, 22 were operated on, 6 by hysterectomy, 10 by unilateral, 4 by bilateral oophorectomy. There was no operative mortality, but the late results were less satisfactory for only 9 women were alive at periods ranging from 1 month to 6 years after operation, respectively. A study of the literature, particularly that emanating from German sources, indicates that in malignant tumors of the ovaries, which form the bulk of solid ovarian new growths, postoperative radiotherapy improves the final results. This book is a very concise and complete survey of the subject.

GEORGE GELLER, M.D.

IN the preface of his book on *Physical Diagnosis*, Dr. Elme states that he consented to revise Dr. Rose's book provided he could rearrange and rewrite the subject matter as seemed necessary to carry out his own ideas. This he has done by an entire rearrangement of the subject matter, which has been divided into parts.

Part I consists first of an excellent discussion of clinical anatomy and physiology. The normal physical signs are discussed and each method of examination in its entirety is covered before proceeding to the next method. This means that the divisions of inspection, palpation, percussion and auscultation are covered with regard to the whole body rather than the usual one of covering each system. From a pedagogic view this appears logical. Added to the description of the normal physical findings is sufficient pathological discussion to bring out the relationship of the two. There are also chapters upon the polygraph and electrocardiograph covering the essential facts as also one upon the use of the X-ray in physical diagnosis.

Part II consists of the application of physical diagnosis to disease.

The book is well written and should be of value to the practitioner and student.

DOV C. SERRIN

Physic. D. W. B. W. P. Elm. B. S. M. D. and W. D.
Rose, M. D. S. Louis. T. C. V. Mosby, Com. y

IN this latest edition *Operative Gynecology* by the two Drs. Crossen has attained the rank of a masterpiece. It is eminently fitting that so splendid a work in a special field which was literally originated and developed by American pioneers should be the product of American gynecologists.

The preface to this the fourth edition, a cross section of the mental processes and attitude of the senior author is a sufficient explanation of the outstanding position held by this text.

In spite of the very great number of titles, subtitles and further subdivisions in each major chapter, the whole is so well systematized with suitable chapter content outlines and general index that each detailed description is readily accessible. The inclusion of the author's preferences in this as in the previous edition must be of real value to those for whom the book must take the place of a senior consultant in making the choice of operative procedure.

The techniques described for linear cauterization of the cervix fail to make clear that the average lesion can be completely treated in one office session by means of a long wire loop for the canal and a fine knife edge loop for the radial treatment of the cervix. Likewise the desirability of removing all mucus first using strong bicarbonate solution or caroid powder followed by adrenalin for hemostasis is necessary.

Diagnostic curettage in the non-pregnant uterus must be preceded by dilatation for which the author recommends the Goodell or similar power dilators carried to 15 or 2 centimeter dilatation. Mention should be made of the great advantage of the graduated snub-nosed Hegar set of dilators, curved metal cylinders ranging by 0.5 millimeters from 6 millimeters to 20 millimeters. A maximum size of 15 millimeters is ample for diagnostic use and increased dilatation with any instrument in the non-pregnant uterus must result in more or less severe splitting of the cervix.

The operative treatment of all types of abortion is omitted. The frequency of its occurrence, the tremendous morbidity and mortality incident to this condition make it imperative to emphasize in such a text as this the surgical principles involved, chief of which is digital exploration and separation of conception rests with the avoidance of the curette.

Among inhalation anesthetics, ethylene oxygen, which is far superior to nitrous oxide oxygen, might have been included since the technique of administration has been developed to a degree of safety from explosiveness that places it on a par with other inhalation anesthetics. For the sake of international comity the selection of cases illustrative of the medico-legal aspect of foreign bodies left in the abdomen could very well have been limited to American examples for which the files of the *Journal of the American Medical Association* could serve as an abundant source.

JOSEPH L. BAER

O. R. A. S. G. V. G. 3d & By H. S. 80 C. S. M. O.
F. A. C. S. D. R. J. C. M. D. th. d. C. S. Lou. Th.
C. V. M. by Comp. y

open to the sun would be sought. Near by would be a spring, a pool and running water, where the ill one could slake his thirst and bathe his body. When his fever had subsided and his illness had passed and the refreshed stranger was on his way, he would look back to his temporary refuge, tell his companions of his sojourn there and of his recovery. It became the first hospital, a place of healing, a pool of Bethesda.

Hospitals had their beginnings when the warrior of old fell from the ranks, wounded or exhausted and was cared for in some secluded glen by those of his fellows who were less severely stricken. They bound up his wounds, quenched his thirst and gave him food. Hospitals had their beginnings when the pyramids were being built and the master workmen were stricken or injured. There on the banks of the Nile, protected from the sun of the desert by the shade of a hut, they were restored to strength.

Hospitals had their beginnings when the children of Israel fled from Egypt and their followers fell by the wayside in their weary trek, and when in their illness they were nursed back to health in the protection of a friendly rock, or were buried by unselfish hands. Hospitals had their beginnings in the dwellings around and about Jerusalem when Christ healed the sick. They had their beginnings in the monasteries of the early Christian days and later in the rooms provided for the poor and the sick by the Bishops.

THE MODERN HOSPITAL

We of this country and our neighbors to the north, the Canadians, have done much to develop the practical hospital for men and women of whatever class. When we speak of medical service in hospitals, the question of rank should not be a consideration. People in hospitals are individuals without property except that they have a bed to rest upon, a blanket to cover them, a light shift to conceal their nakedness. They are like the newborn babe. Therefore we and the Canadians do not segregate according to rank. We have general hospitals where rich and poor alike may receive medical service, and where the members of the medical profession can conveniently and thriftily care for all of their patients under one roof and give each and all of them the advantage of the same management, the same apparatus, the same nurses, orderlies, etc.

Many of you may not realize that in the older countries, century old traditions obtain and that their great hospitals are available exclusively to the poor. These traditions were built up when hospitals were a refuge for the poor, when medical

and surgical treatment was confined exclusively to emergencies and before elective medicine and surgery had developed to the present proportions. Concurrently with the advent of modern surgery, medicine and obstetrics, nursing homes were established to care for the well-to-do patients, or their homes were transformed at great expense and trouble into substitutes for hospitals. The King, a member of Parliament or a cabinet minister of Great Britain could not legally become a patient in St. Bartholomew's or Guy's Hospital of London where every modern hospital facility is available to the poor.

Fifteen years ago the American College of Surgeons undertook the survey and betterment of hospitals. It was a stupendous task. To insure effective work, it was necessary to devise a standard that would meet the criticism and secure the acceptance of hundreds of independent hospitals. Thus a minimum standard was formulated rather than an ideal one. Two years of study, of comparisons and of adjustments of hospital conduct were necessary before the present Minimum Standard was announced. It has stood the test of time and criticism for fourteen years and it has stimulated the adoption of an ideal standard.

Most of you are familiar with the story of the application of this standard, year after year since 1918. The College engaged the services of graduate physicians who visited the hospitals of the United States and Canada and made personal surveys. Each year the College announces the hospitals that have warranted its approval. Dr. Malcolm T. MacFadden is the associate director in charge of Hospital Standardization.

At the annual meeting in 1930 the College presented a summary of the thirteenth survey as follows:

| | |
|---|-------|
| 1 Hospitals of 100 beds and over | |
| Surveyed | 1 433 |
| Fully approved | 1 |
| Conditionally approved | 62 |
| Total fully and conditionally approved | 1 334 |
| Total percentage fully and conditionally approved | 93.1 |
| 2 Hospitals of 50 to 100 beds | |
| Surveyed | 1 001 |
| Fully approved | 48 |
| Conditionally approved | 114 |
| Total fully and conditionally approved | 596 |
| Total percentage fully and conditionally approved | 59.5 |
| 3 Hospitals of 25 to 50 beds | |
| Surveyed | 730 |
| Fully approved | 8 |
| Conditionally approved | 51 |
| Total fully and conditionally approved | 133 |
| Total percentage fully and conditionally approved | 18.2 |

AMERICAN COLLEGE OF SURGEONS

THE DUKE FOUNDATION IN RELATION TO MODERN HOSPITALS AND THEIR RESPONSIBILITY TO THE PUBLIC AND THE MEDICAL PROFESSION

FRANKLIN H. MARTIN, MD, FACS, C. I. G. O.

Dir. t. G. I. Am. Coll. g. I. S. g. o.

IT is inspiring for a modern Yankee to be invited to the Carolinas. Carolinians from the beginning of our country and long before have done their own thinking and in our fight for independence their thinking was backed by an action that made them influential in that group of thirteen of which they were a part. At all times their culture, their social proclivities and their educational ambition has placed them in a class by themselves in this Empire of the South.

Particularly am I glad to be a guest of North Carolina where live a group of my most valued friends. One of your greatest surgeons was a tower of strength to me in the organization of the General Medical Board of the Council of National Defense during the Great War—Dr. Hubert A. Poyster.

One more friend, a neighbor of yours who has surprised us and honored us by his presence this evening. I cannot refrain from mentioning—Mr. Josephus Daniels. For nearly two years I was associated with him in the meetings of the Council of National Defense. We found him to be (I quote from my Diary) a keen, quiet man who attended strictly to his own business and whose most prominent personal characteristic was his very great modesty. He quickly without apparent effort won his way into our inner recesses and he was early counted as someone to tie to as a real friend and whom one would always find a willing and sympathetic counselor.

His opinions were pointedly and clearly stated and of course without any appearance of embarrassment. And in accomplishments he was a past master. His department was driven by him in stead of the reverse. He had the training of a newspaper editor and manager—the paper was always out on time and distributed before most people were up.

In our important discussions when departmental activities were being considered and his work was brought forward we soon learned to

say, "We don't have to bother with that. It pertains to Secretary Daniels' department."

His modesty, his great accomplishments, his broad vision and his defense of principles won our admiration. And when the final history of the Great War is written, Josephus Daniels will be recorded as outstanding among our great Secretaries of the United States Navy.

Secretary of War Newton D. Baker, whom we all also admired, was known as the "little giant" and Secretary Daniels in distinction was affectionately dubbed the "silent giant."

JAMES BUCHANAN DUKE

And now we come to look upon the work of another North Carolinian—to view its far reaching immensity, to admire and to applaud.

James Buchanan Duke was well named. By his vision he has proved that he was not only a Duke but a sovereign—an accomplisher of things, a servant of mankind. Here about us is the evidence in substantial beauty of his vision and his practical philosophy. Irresistibly the indicator of the medical center is moving toward the South. And the enviable standard of your hospitals will be further enhanced if full advantage is taken of existing opportunity.

All of the money in the world however will not create a great medical center. It required the activity of the Big Four of Hopkins—Welch, Halsted, Kelly, and Osler—to place that institution on the map. Here we have a like beginning with W. S. Rankin and Wilburt C. Davison whose responsibility is stupendous.

BEGINNING OF HOSPITALS

Hospitals had their beginnings in the earliest days when the shade of the low wall or the tree by the roadside was utilized by the wayfarer and it was here that the worker or the pilgrim stopped exhausted in his illness and was cared for by his companions. If it were cold the protected cave

HEALTH INVENTORIUM

THE REQUIREMENTS

The hospital should furnish an examining room or rooms to which any legalized practitioner (who is a member in good standing of the American Medical Association and of his respective county medical society of the Canadian Medical Association and its subsidiary branches or similar medical organizations in the South and Central American Republics who accept the advice of the American College of Surgeons) may bring a patient for examination.

The hospital should furnish to the practitioner every facility in the way of aids consultants when necessary laboratory tests etc. as will insure a comprehensive audit of his patient's condition. The charge for the required laboratory tests should be nominal and the maximum not to exceed actual cost. There should be no charge for the use of the examining room. The physician should render to the patient (if he is able to pay) a bill

covering the fee for the examination and where there is a charge for laboratory services be should be responsible to the hospital for its payment.

SAFEGUARDS

1 To insure protection to the practitioner no hospital should accord these facilities to any individual who is not accompanied by his or her doctor or who does not carry a letter from his or her doctor in which certain services are requested.

2 An individual who applies for an examination and who has no physician should be referred to a duly appointed disinterested committee consisting of a representative or representatives of the local medical society and the standardized hospitals of the community and this committee should advise the patient in the selection of a physician.

3 Each hospital volunteering to establish such facilities will be accredited as conducting a Health Inventorium.

prehensive machine, or he is outclassed by a combination of time servers.

Most of the qualified practitioners who graduated in medicine within the last thirty years received the degree of M.D. from Class A medical schools affiliated with endowed universities of the United States or Canada. They served one or two years as internes in approved hospitals and their study and training were not confined to one specialty but embodied all branches of medicine.

Upon graduation they are confronted with the decision to accept or refuse attractive positions—ready made service as salaried aids in the field of public health or in philanthropic foundations as full time aids or assistants in endowed dispensaries or university clinics as health administrators of hospitals or private health organizations as professional guides in publicity of health guilds or charitable organizations or possibly as medical or surgical administrators of industrial plants. Organizations of this type and others too numerous to mention offer an immediate fixed salary and furnish offices with willing aids who will lend dignity to the positions. Alluringly these inducements are urged for consideration.

If the young graduates resist the temptation of these attractive salaried positions they are aware of the obvious fact that even though they possess the necessary training they cannot be proficient in all branches of scientific medicine

without suitable apparatus and laboratory facilities. To maintain their independence where could they receive such aid to better advantage than in an approved hospital?

A solution of the independent practitioners problems reveals an added function for the community hospitals that are supported by private and public funds. It reveals the fact that the hospital has all the requirements in laboratories scientific apparatus and trained technicians and medical aids that are the boast of the most approved diagnostic clinic. Hence the College has suggested to the approved hospitals that they extend their diagnostic facilities to independent qualified practitioners of scientific medicine through a department to be known as a Health Inventorium. (Approximately forty per cent of the independent family doctors of the United States and Canada are already members of hospital staffs. The remaining sixty per cent should have the facilities of a Health Inventorium.)

And what hospital would suffer professionally financially or scientifically by extending the privilege of a diagnostic clinic to every modern educated doctor? What community of people would not be benefited by this extension of hospital privileges to their own family doctor? And of the greatest importance, what other method can be devised that will save the independent medical practitioner from extinction and our profession

MINIMUM STANDARD FOR HOSPITALS

That physicians and surgeons privileged to practice in the hospital be organized as a definite group or staff. Such organization has nothing to do with the question as to whether the hospital is open or closed nor need it affect the various existing types of staff organization. The word staff is here defined as the group of doctors who practice in the hospital inclusive of all groups such as the regular staff, the visiting staff and the associate staff.

2 That membership upon the staff be restricted to physicians and surgeons who are (a) full graduates of medicine in good standing and legally licensed to practice in their respective states or provinces (b) competent in their respective fields and (c) worthy in character and in matters of professional ethics that in this latter connection the practice of the division of fees under any guise whatever be prohibited.

3 That the staff initiate and with the approval of the governing board of the hospital adopt rules, regulations and policies governing the professional work of the hospital that these rules, regulations and policies specifically provide:

(a) That staff meetings be held at least once each month. (In large hospitals de-

partments may choose to meet separately.) (b) That the staff review and analyze at regular intervals their clinical experience in the various departments of the hospital such as medicine, surgery, obstetrics and the other specialties; the clinical record of patients free and pay to be the basis for such review and analysis.

4 That accurate and complete records be written for all patients and filed in an accessible manner in the hospital—a complete case record being one which includes identification data, complaint, personal and family history, history of present illness, physical examination, special examinations such as consultations, clinical laboratory, X-ray and other examinations, provisional or working diagnosis, medical or surgical treatment, gross and microscopic pathological findings, progress notes, final diagnosis, condition on discharge, follow up and in case of death, autopsy findings.

5 That diagnostic and therapeutic facilities under competent supervision be available for the study, diagnosis and treatment of patients; these to include at least (a) a clinical laboratory providing chemical, bacteriological, serological and pathological services (b) an X-ray department providing radiographic and fluoroscopic services.

4. Government hospital

| | |
|--|-----|
| (a) Army | |
| Surveyed | 5 |
| Fully approved | 5 |
| Percentage fully approved | 100 |
| (b) Navy | |
| Surveyed | 3 |
| Fully approved | 13 |
| Percentage fully approved | 100 |
| (c) Public Health Service | |
| Surveyed | 4 |
| Fully approved | 24 |
| Percentage fully approved | 100 |
| (d) Veterans Bureau | |
| Surveyed | 49 |
| Fully approved | 49 |
| Percentage fully approved | 100 |
| (e) National Homes for Disabled and Volunteered Soldiers | |
| Surveyed | |
| Fully approved | 10 |
| Percentage fully approved | 100 |

5. Other Countries

Twenty-five hospitals of other countries have been awarded full approval and are defined in this list

of Approved Hospitals for 1930 (Australia, Canada, France, Newfoundland, New Zealand and Uruguay)

| SUMMARY | |
|--|-------|
| Total fully approved | 1,836 |
| Total conditionally approved | 227 |
| Total fully and conditionally approved | 2,063 |
| Total not approved | 110 |
| Totals surveyed | 3,164 |

THE MODEL HOSPITAL

May I now suggest to this Duke Foundation which has accepted the hospital leadership in these two commonwealths an amplification of its program which will consider the establishment and conduct of hospitals with more far-reaching activities than those commonly performed by our present approved institutions. The profession of scientific medicine with the modern demand upon it for varied and costly scientific equipment and skilled medical aids and technicians, is rapidly losing its position of power and independence.

The public is confused. The family adviser—the family doctor—in many communities is difficult to find. If occasionally he is discovered it is apparent that he has become the head of a com-

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5 That diagnostic and therapeutic facilities under competent supervision be available for the study, diagnosis and treatment of patients, these to include at least: (a) a chemical laboratory providing chemical, bacteriological, serological and pathological services; (b) an X-ray department providing radiographic and fluoroscopic services.

4 Government hospitals

(a) Army

| | |
|---------------------------|-----|
| Surveyed | 5 |
| Fully prepared | 5 |
| Percentage fully approved | 100 |

(b) Navy

| | |
|---------------------------|-----|
| Surveyed | 13 |
| Fully prepared | 3 |
| Percentage fully approved | 100 |

(c) Public Health Service

| | |
|---------------------------|-----|
| Surveyed | 4 |
| Fully prepared | 24 |
| Percentage fully approved | 100 |

(d) Veterans Bureau

| | |
|---------------------------|-----|
| Surveyed | 49 |
| Fully approved | 49 |
| Percentage fully approved | 100 |

(e) National Homes for Disabled and V.I. Unit Soldiers

| | |
|---------------------------|-----|
| Surveyed | |
| Fully approved | |
| Percentage fully approved | 100 |

5 Other countries

Twenty-five hospitals in other countries have been awarded full approval and are included in the list.

Approved Hospitals for 1930 (Australia, Canada, France, Newfoundland, New Zealand and Uruguay)

| SUMMARY | |
|--|-------|
| Total fully approved | 836 |
| Total conditionally approved | 7 |
| Total fully and conditionally approved | 843 |
| Total at present | 1 |
| Total surveyed | 3,164 |

THE MODEL HOSPITAL

May I now suggest to this Duke Foundation which has accepted the hospital leadership in these two commonwealths, an amplification of its program which will consider the establishment and conduct of hospitals with more far-reaching activities than those commonly performed by our present approved institutions. The profession of scientific medicine with the modern demand upon it for varied and costly scientific equipment and skilled medical aids and technicians is rapidly losing its position of power and independence.

The public is confused. The family adviser—the family doctor—in many communities is difficult to find. If occasionally he is discovered it is apparent that he has become the head of a com-

MINIMUM STANDARD ON INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

1 That all hospitals receiving traumatic cases for treatment be required to meet the minimum standard requirements of the American College of Surgeons

2 That each of these hospitals shall have a committee responsible for the supervision of traumatic surgery

3 That a surgeon approved to treat traumatic cases shall be (a) a graduate of scientific medicine in good standing and licensed to practice in his respective State or province (b) competent in the field of traumatic surgery (c) worthy in character and in matters of professional ethics that in the latter connection the practice of division of fees under any guise whatever be prohibited

4 That surgeons dealing with traumatic cases shall keep accurate and complete clinical record of all patients—in accordance with the minimum requirements of the American College of Surgeons paying special attention to the immediate record of injury detailed description of physical findings adequate record of treatment a record of estimated period of disability the end results when possible and these records shall be filed so that they are available at all times for submission as shall be required

5 That all surgeons and hospitals dealing with traumatic cases shall have available adequate diagnostic and therapeutic facilities

that are qualified is determined by this survey the results of which form the basis of the annual report to the public Each standardized hospital can furnish the practitioner with the necessary equipment and aids to insure the comprehensive examination of a patient Such facilities are already furnished by many hospitals especially community hospitals to the legalized practitioners within their districts

CANCER CLINICS

It appears self evident that at least one standardized hospital in each community should maintain an approved cancer clinic whose facilities and service would be available to all scientific doctors

The Committee on the Treatment of Malignant Diseases of the American College of Surgeons under the chairmanship of Dr Robert B Greenough of Boston and Associate Director Bowman C Crowell of the College has been a leader in this work for fourteen years has made yearly reports of progress and has announced a concrete standard for Cancer Clinics particularly applicable to approved hospitals

This standard speaks for itself

The Duke Foundation with its existing plans for hospital organization could very properly take the lead in providing cancer clinics in which all independent physicians could have access to the facilities for diagnosis and treatment of their patients under the supervision and guidance of an organized cancer service

INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

A Minimum Standard on Industrial Medicine and Traumatic Surgery was formulated by the

American College of Surgeons in 1926 It was the outcome of meetings on several successive days which were participated in by outstanding lay and medical leaders in industry in labor in indemnity insurance and industrial physicians and surgeons

The standard has been carefully studied by officials representing industry labor insurance companies the medical profession hospitals and administrators of State compensation laws and in principle it has been approved by all of them With the co operation of medical representatives in industry the working details have been perfected and the College is now ready to aid in the establishment of model departments along these suggested lines and to assist in perfecting any comparable services as are already in existence The College is enlisting the co operation of the 2063 hospitals on its approved list in this far reaching program the importance of which cannot in my opinion be exaggerated

Dr Frederic A Besley is the chairman of the Board on Industrial Medicine and Traumatic Surgery

HIGH COST OF MEDICAL AND SURGICAL CARE

The high cost of medical and surgical care has been the subject of much recent discussion and of many great conferences With but few exceptions the resulting recommendations which promise lower costs of treatment tend to eliminate the independent practitioner of medicine Why? Because the independent family doctor cannot duplicate the expensive apparatus and therapeutic facilities that are available to his more fortunate fellow practitioners who are on the staffs of approved hospitals equipment that is essential if

MINIMUM STANDARD FOR CANCER CLINICS

1 *Organization* There shall be a definite organization of the service and it shall include an executive officer and representatives of all the departments of the hospital which are concerned in the diagnosis and treatment of cancer. The services of a secretary and of a social service worker shall be available.

2 *Conferences* As an essential feature of the service there shall be regular conferences or consultations at which the diagnosis and treatment of the individual cases are discussed by all members of the clinic who are concerned with the case.

3 *Patients* Reference to the cancer clinic of all patients in whom the diagnosis or treatment of cancer is to be considered shall be either voluntary or obligatory in accordance with the vote of the medical staff or of the governing board of the hospital.

4 *Equipment* In addition to the diagnostic and therapeutic surgical equipment which is required in every approved general hospital there shall be available an apparatus for X-ray therapy of an effectiveness generally

agreed upon as adequate and an amount of radium sufficient to insure effective treatment.

5 *Records* In addition to the records which are required in every approved general hospital there shall be additional records of (a) The details of the history and of the examination for cancer in different regions of the body such as are indicated on the form records which are recommended by the Committee on the Treatment of Malignant Diseases American College of Surgeons (b) The details of the treatment by radium or X-ray as indicated on the form records which are recommended by the Committee on the Treatment of Malignant Diseases American College of Surgeons (c) Periodic examinations at intervals for a period of at least five years following treatment.

6 *Treatment* The treatment of cancer patients shall be entrusted to the members of the staff of the cancer clinic except in cases in which adequate treatment in accordance with the collective recommendation of the staff of the cancer clinic can be procured otherwise.

from dependency commercialism state control or socialism?

The plan of administration that the College suggests to hospitals is as follows:

First Furnish diagnostic facilities to all educated licensed graduates in scientific medicine through Health Inventoriums.

Second Furnish facilities for the diagnosis and treatment of cancer through organized cancer clinics.

Third Furnish in all communities facilities for the care of the injured in and out of industry through organized traumatic clinics.

HEALTH INVENTORIUM

Five years ago the American College of Surgeons developed a plan which would furnish to the doctor of every community the necessary equipment laboratory facilities and trained aids that would enable him to compete in scientific accuracy with his more fortunate fellow practitioners who have hospital or organized clinic affiliations and gave him ready access to all of these necessities.

The College's announcement read: A diagnostic clinic in every community, the family physician furnished with diagnostic facilities similar to those accorded to the attending staffs of most approved clinics or hospitals.

PERIODIC HEALTH EXAMINATIONS

Every intelligent individual now realizes the importance of submitting himself or herself to a health audit or examination at least once each year. This procedure has been advocated by health societies, it has been preached from lay platforms and church pulpits, it has been recommended by authors of health columns, and it has been earnestly advised by the family doctor.

The majority of people who are inclined to accept this advice have family physicians upon whom they depend in time of sickness. In considering the periodic health examination naturally they turn to these same family doctors. But without the apparatus of precision the family doctor is unable to make a complete survey of his patients or record complete findings. No educated physician should be subjected to this embarrassment.

THE PLAN

There are more than 3,200 hospitals in the United States and Canada that are under survey by the American College of Surgeons. Of these 2,063 are known as standardized institutions and others are rapidly qualifying.

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DISEASES OF THE URINARY TRACT IN INFANCY AND CHILDHOOD

HERMAN L. KRETSCHMER, M.D., F.A.C.S., CHICAGO
From the Children's Memorial Hospital and the Presbyterian Hospital, Chicago

IN the past decade the literature on modern urology in infancy and childhood has increased to such an extent that the only word applicable to it is "enormous." The most gratifying note to this building up of the literature is the fact that the American urologists have contributed more to this special field of study than have the urologists of any other country. The American urologist has done much significant work, too, in the development of urology, for he has contributed in large measure to the development of the small cystoscope which makes possible an accurate study of the patients afflicted with urologic conditions. The recent introduction into our diagnostic armamentarium of intravenous urography has placed another agent in our hands that will, no doubt, be of great help in advancing the study of urologic cases.

That lesions of the urinary tract in children are easily overlooked is due to several factors. The average urologist does not see these patients frequently nor early enough, and the general practitioner who as a rule is the first to see such patients and many times at the very onset of the trouble fails very often to appreciate the problem before him with the result that no effort is made to study accurately the clinical problem presented. Perhaps part of this failure is due to the training of the general practitioner as a medical student. But even the pediatrician who has the advantage of having had special

training and who sees many of these patients may be charged with being rather slow to avail himself of our modern diagnostic procedures.

Now it is a fact that the teachings and writings of the older urologists as well as of the older pediatricians are devoid of references to urological lesions as we know them at present. But today urology is an exact science as is pediatrics; hence it would seem that pediatrics should keep pace with the most modern teachings of urology. Unfortunately, however, wholehearted cooperation between the general practitioner and the urologist and what is more important between the pediatrician and the urologist is still lacking. The matter of cooperation—its great advantages to the patient—should be dwelt upon in our medical schools so that the student may grasp its import long before he enters the practice of medicine and in our large teaching hospitals our large general hospitals and among practitioners in their daily work outside hospitals it should be an everrecurrent subject. Just why the lack of cooperation continues is not quite clear, especially in view of the fact that the little patient is consequently subjected to undue suffering. It would seem that the welfare of the patient should always be the first consideration.

In their recent monograph on diseases of the urinary tract in children Beer and Hyman

he is to furnish the highest type of service to his patient. Here is where influential organizations like the Duke Foundation can render most valuable aid to the independent doctor by encouraging the hospitals under their jurisdiction to establish Health Inventoriums. Other approved hospitals will follow the example of such action when it is observed that it will extend valuable service to the public and to the independent physician and lead to advantages that will not only enlist universal approval but also financial support.

Of the 168 000 physicians and surgeons recorded in the United States and Canada who have graduated in scientific medicine and earned the degree of M.D. the independent family physicians number about 100 000. The remaining medical graduates comprise the practitioners who are rendering valuable and necessary service as salaried public health officials of the government, the State, the county and the municipality and semi-philanthropic organizations, the Army, the Navy and the Marine Corps, public and private group clinics for diagnosis and treatment, full time teachers in medical schools, resident physicians in hospitals, administrative and professional internes and hospital superintendents, medical and surgical administrators in industry and doctors who have retired voluntarily or for other reasons from the practice of medicine.

Hence the independent practitioner upon whom we must depend for personal advice and personal visits—the family doctor—approximates sixty per cent of the independent scientific medical profession. He alone depends upon his own efforts to support his family and his paramount interest is in the practice of medicine as a profession among the families of his community.

SUMMARY

1. Prevention has become an outstanding factor in medicine. The people are more and more interested in the practical application of preventive measures in dealing with personal health. They realize that more than one third of our boys who were examined for service in the Great War were declared to be unfit.

Twenty five years ago but a scattering few appreciated the advantages of a periodic health examination whereas millions are now demanding

this service. The increase in health audits ranges in some communities from 100 to 1 000 per cent.

The majority of the people prefer to go to their own family doctor for these examinations. This desire is so universal and the beneficial results of the examinations are so obvious that the general practitioner is now called upon to apply preventive as well as curative measures in his every day practice. What greater and more appropriate service could the Duke Foundation render to the people and to the profession than to establish model Health Inventoriums?

2. The public is mindful too of the great menace of cancer and of the fact that this disease with its annual toll of approximately one hundred and forty thousand individuals can be prevented if it is discovered early and proper treatment applied. Cancer clinics in community hospitals will give the people and their physicians every modern facility for scientific examination and the most approved methods of treatment. What would be more appropriate than that the Duke Foundation should establish such cancer clinics as models for all approved hospitals?

3. The industries great and small, those serving in industry and physicians who are called upon to care for the thousands of traumatic cases outside of industry are seeking opportunities for better service. Some of the larger industries already provide such facilities to their people. Who can better aid in giving service to the smaller industries than the community hospitals? Thousands of traumatic injuries occur outside of industries. Who can better provide appropriate and economical service in these cases than these same community hospitals?

These problems are acute. The American College of Surgeons is in dead earnest in its desire to help in solving them in its desire to enter into partnership with all modern hospitals in its desire to aid the educated practitioner of medicine to obtain economical facilities for his work and in its desire to reduce the cost of medical care to the people by supporting the independent doctor instead of eliminating him.

In this partnership of course we of the American College of Surgeons hope for the enthusiastic cooperation of the Duke Foundation.

While there may be some doubt as to the causal relationship between head infections and pyelitis still the mother's statement should be given consideration especially when several attacks of pyelitis are preceded by head infections

EXAMINATION

Physical examination should of course precede any and all instrumental examinations. A careful physical examination will often give one a definite idea of the underlying pathology. For example the presence of a suprapubic tumor in a boy who has great difficulty in urinating or the presence of a suprapubic tumor in a case of so called enuresis is a valuable piece of evidence and is obtainable in a few moments. In lesions of the kidney such as tumors or large hydro-nephroses the presence of a tumor again helps to direct our attention at once to the seat of the pathology.

Examination of urine Before any sort of instrumental examination is undertaken a careful study of the urine should be carried out preferably daily examination. The presence of pus cells or red blood cells is often of great value as is the presence of bacteria or casts. It is a well recognized clinical fact that in some cases of pyelitis the urine may be clear early in the onset of the disease when the temperature is high but subsequent examinations will show the presence of pus. This illustrates how important it is to make a daily urinary examination in this group of cases. In girls the urine should always be obtained with a catheter.

Röntgen ray examination The next step in logical sequence is the roentgen ray examination of the urinary tract since this is a relatively easy and simple procedure. The presence or absence of stones or the presence of areas of calcification in cases of renal tuberculosis may be quickly demonstrated and bony defects such as spina bifida occulta if present come into view.

Estimation of residual urine Estimation of residual urine is a relatively easy procedure to carry out and yields important information. It should be done in every case presenting a suprapubic tumor either with a history

of difficult urination for a long period of time and a history of dribbling or of incontinence or when these symptoms are lacking. It is needless to say that the estimation must be carried out under strict antiseptic and aseptic precautions. In case the tumor is very large the suspicion being that the residual is high the better procedure is to withdraw only part of the urine and to institute gradual decompression.

Determination of renal function Next in order is a study of the renal function. This can be carried out by measuring the fluid intake and the fluid output estimating the specific gravity of urine and making a test of the output of urea. A blood chemistry examination should always be made in every case before a cystoscopic examination is made. One occasionally encounters cases in which there is present enormous dilatation of the kidney pelvis and ureters with resulting atrophy of the kidney. These patients are skating on thin ice. If for example they have recently weathered the storm of an acute renal infection with impaired renal function it might be better to defer the cystoscopic examination and ureteral catheterization until the renal function can be improved. The rule should always be to study carefully the kidney function before subjecting the patient to cystoscopic examination ureteral catheterization and pyelography. Mixed phthalein tests can also be carried out or the use of indigocarmine may be employed in conjunction with the cystoscopic examination so called chromocystoscopy.

Intra-venous pyelography With the introduction of uroselectan into our diagnostic armamentarium a decided improvement has been made in the management of this group of cases. The use of this drug no doubt will simplify the clinical investigation of these little patients and will avoid subjecting at least some of them to cystoscopic examination and ureteral catheterization. The children seem to tolerate uroselectan well and in my experience we have secured excellent urograms without untoward reactions. In the cases in which the lower ureter is to be studied or to be shown especially clearly it is necessary to drain the bladder with an

report a large series of cases based upon their experiences at Mt Sinai Hospital in New York. Not only is the monograph a great tribute to the splendid co-operation between the pediatrician and the urologist but it shows that in a large general hospital diseases of the urinary tract are relatively frequent and that by co-operation and intensive study a group of interesting cases can be found. There is no doubt in my mind that their experiences can be duplicated in many of our large hospitals as well as in our out patient departments.

Because no one man sees a large number of these patients reports of cases together with the experiences of the author in dealing with them serve a useful purpose in adding to the general fund of knowledge. Furthermore these contributions cannot but stimulate others to record their experiences. Recent articles show unmistakably that these lesions are much more common than was formerly thought to be the case. Pediatric urology offers wonderful possibilities of clarifying many extremely interesting and intricate problems not only with regard to diagnosis but with regard to both medical and surgical treatment. As the urologist well knows a large number of patients come to him for diagnosis and treatment who have had symptoms for several years and suffer from organic disease. These patients often have lesions which are the direct result of obstruction—lesions which cause irreparable damage.

It is impossible to include in this address the names of all the individuals who have played a rôle in the development of this new and fascinating subject. Suffice it to say that by their labors each and every one of them has helped to advance the cause which I am pleading—the dissemination of knowledge on the subject of diseases of the urinary tract in infancy and childhood.

That the published reports of these men have borne fruit is indicated by the increasing number of articles on urology, the increasing number of special departments which have been established for urology in children's hospitals and finally the requests by pediatricians ever increasing in number for urological consultations with urologists. No

more striking evidence of this keen appreciation can be mentioned than that in a recent article by Helmholtz on congenital abnormalities of the urinary tract in children Helmholtz says that the pediatricians are not doing their duty so long as they continue to treat a patient with chronic pyelitis for months or even years without calling in a urologist to rule out complicating abnormalities of the urinary tract.

THE TAKING OF THE HISTORY

In the management of urological problems in infancy and childhood it is extremely desirable to carry the patients through a well established or definite routine. First an accurate history should be obtained not only of the present trouble but of all past illnesses. This task of course is at times an extremely difficult one due to the fact that the mother or nursemaid has not been very observant. Furthermore the age of the patient precludes his being interrogated or makes it difficult for him to express in specific terms just what his symptoms are. On the other hand careful detail requiring extreme patience in regard to eliciting the history will often reward one with valuable information. For example in one patient sent in with a diagnosis of sarcoma of the kidney the mother stated that the tumor in the left flank varied in size at times being small at times large a phenomenon not present in a malignant tumor but one that may be seen in a hydronephrosis. This case subsequently proved to be a hydronephrosis. The point I wish to emphasize is that the keen observation of the mother was a decided factor in establishing the diagnosis.

The history of disturbances in the gastrointestinal tract is of great importance especially in cases of so called relapsing pyelitis. To treat such patients by pelvic lavage to allow the gastro intestinal lesions to persist and thus to feed colon bacilli into the kidneys does not make for great progress in clearing up the renal infection when the primary lesion is in the gastro intestinal tract. One should not fail to delve into a history of acute infections of the throat such as repeated attacks of tonsillitis as well as of acute coryza conditions sometimes followed by pyelitis.

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THE TAKING OF THE HISTORY

In the management of urological problems in infancy and childhood it is extremely desirable to carry the patients through a well established or definite routine. First an accurate history should be obtained not only of the present trouble but of all past illnesses. This task of course is at times an extremely difficult one due to the fact that the mother or nursemaid has not been very observant. Furthermore the age of the patient precludes his being interrogated or makes it difficult for him to express in specific terms just what his symptoms are. On the other hand careful detail requiring extreme patience in regard to eliciting the history will often reward one with valuable information. For example in one patient sent in with a diagnosis of sarcoma of the kidney the mother stated that the tumor in the left flank varied in size at times being small at times large a phenomenon not present in a malignant tumor but one that may be seen in a hydronephrosis. This case subsequently proved to be a hydronephrosis. The point I wish to emphasize is that the keen observation of the mother was a decided factor in establishing the diagnosis.

The history of disturbances in the gastrointestinal tract is of great importance especially in cases of so called relapsing pyelitis. To treat such patients by pelvic lavage to allow the gastro intestinal lesions to persist and thus to feed colon bacilli into the kidneys does not make for great progress in cleaning up the renal infection when the primary lesion is in the gastrointestinal tract. One should not fail to delve into a history of acute infections of the throat such as repeated attacks of tonsillitis as well as of acute coryza conditions sometimes followed by pyelitis.

While there may be some doubt as to the causal relationship between head infections and pyelitis still the mother's statement should be given consideration especially when several attacks of pyelitis are preceded by head infections

EXAMINATION

Physical examination should of course precede any and all instrumental examinations. A careful physical examination will often give one a definite idea of the underlying pathology. For example the presence of a suprapubic tumor in a boy who has great difficulty in urinating or the presence of a suprapubic tumor in a case of so called enuresis is a valuable piece of evidence and is obtainable in a few moments. In lesions of the kidney such as tumors or large hydronephroses the presence of a tumor again helps to direct our attention at once to the seat of the pathology.

Examination of urine Before any sort of instrumental examination is undertaken a careful study of the urine should be carried out preferably daily examination. The presence of pus cells or red blood cells is often of great value as is the presence of bacteria or casts. It is a well recognized clinical fact that in some cases of pyelitis the urine may be clear early in the onset of the disease when the temperature is high but subsequent examinations will show the presence of pus. This illustrates how important it is to make a daily urinary examination in this group of cases. In girls the urine should always be obtained with a catheter.

Röntgen ray examination The next step in logical sequence is the roentgen ray examination of the urinary tract since this is a relatively easy and simple procedure. The presence or absence of stones or the presence of areas of calcification in cases of renal tuberculosis may be quickly demonstrated and bony defects such as spina bifida occulta if present come into view.

Estimation of residual urine Estimation of residual urine is a relatively easy procedure to carry out and yields important information. It should be done in every case presenting a suprapubic tumor either with a history

of difficult urination for a long period of time and a history of dribbling or of incontinence or when these symptoms are lacking. It is needless to say that the estimation must be carried out under strict antiseptic and aseptic precautions. In case the tumor is very large the suspicion being that the residual is high the better procedure is to withdraw only part of the urine and to institute gradual decompression.

Determination of renal function Next in order is a study of the renal function. This can be carried out by measuring the fluid intake and the fluid output estimating the specific gravity of urine and making a test of the output of urea. A blood chemistry examination should always be made in every case before a cystoscopic examination is made. One occasionally encounters cases in which there is present enormous dilatation of the kidney pelves and ureters with resulting atrophy of the kidney. These patients are skating on thin ice. If for example they have recently weathered the storm of an acute renal infection with impaired renal function it might be better to defer the cystoscopic examination and ureteral catheterization until the renal function can be improved. The rule should always be to study carefully the kidney function before subjecting the patient to cystoscopic examination ureteral catheterization and pyelography. Mixed phthalein tests can also be carried out or the use of indigocarmine may be employed in conjunction with the cystoscopic examination so called chromocystoscopy.

Intravenous pyelography With the introduction of uroselectan into our diagnostic armamentarium a decided improvement has been made in the management of this group of cases. The use of this drug no doubt will simplify the clinical investigation of these little patients and will avoid subjecting at least some of them to cystoscopic examination and ureteral catheterization. The children seem to tolerate uroselectan well and in my experience we have secured excellent urograms without untoward reactions. In the cases in which the lower ureter is to be studied or to be shown especially clearly it is necessary to drain the bladder with an

indwelling catheter. In my series of cases in which uroselectan was used there was one case in which wrong conclusions were reached from the reading of the urograms. This case will be discussed in detail under differential diagnosis.

Cystoscopy and ureteral catheterization. The last steps in the examination are cystoscopy, ureteral catheterization, pyelography and the bacteriological study of the separated urines as well as a very careful study of the renal function. It may be advisable in certain cases to defer pyelography for a subsequent examination.

DIFFERENTIAL DIAGNOSIS

Although in a child or infant the presence of a palpable tumor in the upper abdomen with associated symptoms of fever and loss of weight generally justifies the diagnosis of malignant tumor of the kidney, instances may arise in which the malignancy may be located in some other abdominal organ. While malignant tumors are rare in infants and children it is a well known fact that malignant disease does occur in these little patients as is shown in the recent articles dealing with malignant diseases in infancy and childhood by Bondy on Angiosarcoma of the Liver, by Castle on Primary Carcinoma of the Liver, by Downes on Tumors of the Ovary, by Fullerton on Sarcoma of the Small Intestine, by Harris on Carcinomatous Ovarian Teratoma, and by Mixter on Sarcoma of the Bladder.

Intravenous pyelography with uroselectan should prove of great value in making a differential diagnosis. Great care should be exercised however in interpreting the films. For example, we might mention an interesting case in which malignancy of the kidney was suspected. Pyelograms were made after the injection of uroselectan.¹ On the one side a normal pyelogram was obtained but on the opposite side that is the side with the suspected tumor no kidney shadow was obtained. It was somewhat difficult to read these films as there was present a large soft parts shadow made by the tumor and as an insufficient amount of uroselectan had been

injected. From the evidence obtained a tentative diagnosis of malignant renal tumor might well have been made. However in order to check the findings obtained by means of intravenous pyelography, bilateral pyelograms were made from below and this time we secured normal pyelograms. This case plainly illustrates that we cannot be too careful when interpreting intravenous pyelograms.

CASE ILLUSTRATING IMPORTANCE OF CORRECT INTERPRETATION OF FILMS

Bilateral carcinoma of the ovaries

CASE 1. E. C. female aged 3 years 9 months referred by Dr. Charles Schott was admitted to the Children's Memorial Hospital July 21, 1930. Two months before admission to the hospital the mother noticed that the child was extremely pale, was losing weight, ate very little, was very irritable and the abdomen looked larger than usual. Several weeks later the mother noticed a rapid enlargement of the abdomen which was much more noticeable on the right side. There was some frequency, the child had to urinate three or four times at night. Before admission to the Children's Hospital the child had been in another hospital where an injection of uroselectan had been made on the left side; the pyelogram was normal and on the right side no kidney shadow was seen. A diagnosis of tumor of the right kidney was made. The patient was then sent to the Children's Hospital.

Physical examination disclosed a very prominent abdominal fluid in the peritoneal cavity, a hard fixed nodular mass in the right side and enlarged inguinal glands. Wassermann test gave a negative reaction. Blood examination showed red blood cells 3,200,000, leucocytes 8,400, hemoglobin 58 per cent. Blood chemistry: uric acid 5.7, creatinine 1.8, non protein nitrogen 45.7.

Urinalysis: albumin 0, blood 0, sugar 0, many bryales and a few granular casts. Cystoscopic examination was negative. The ureters were catheterized without difficulty or obstruction. The specimens of urine obtained from the right and left kidneys and bladder were negative and sterile upon culture. The pyelograms right and left were normal.

Diagnosis: primary ovarian tumor with metastases to the liver.

Result: the child faded very rapidly and died 10 days after admission to the hospital. Autopsy examination was made by Dr. W. G. H. whose findings were bilateral carcinoma of the ovaries.

Problems in differential diagnosis may arise in cases of appendicitis for instance when an appendiceal abscess is adherent to the bladder and produces bladder symptoms that predominate the clinical picture or when in

association with bladder symptoms, blood and pus are found in the urine. In such cases it is necessary to differentiate an acute appendicitis from an acute pyelocystitis. When this extremely difficult problem presents itself a complete urologic survey can be carried out without harm or causing much danger from the slight delay incident to a rapidly earned out cystoscopic examination ureteral catheterization and pyelography.

MALIGNANT TUMORS OF THE KIDNEY

As may be seen from a review of the literature malignant tumors of the kidney are rarely found in infants and children. In a review of 4,903 autopsies Bugbee and Woolstein reported no cases of malignant renal tumor. In an analysis of statistics relative to the incidence of kidney tumors in human beings, Hinman and Kutzman found 128 renal tumors in 47,000 adult cases, a percentage of 0.25 or 1 in 400. In 20,470 children they found 14 cases, a percentage of 0.60 or 1 in 2,500. These statistics clearly demonstrate that renal tumors are about four times as common in adults as they are in children.

Kidney tumors may be divided into three groups based on point of origin.

1 Tumors having their origin in the renal capsule itself. Such tumors are rare.

2 Tumors of the kidney pelvis. This group is even less common than Group 1 according to Gilbert Thomas they are less common than tumors of the parenchyma.

3 Tumors of the renal parenchyma. This group comprises the most common type of malignant renal tumor.

Some confusion still exists as to the nomenclature of kidney tumors. It is generally admitted at the present time that the most common type of tumor is the so called mixed tumor of Wilms. In a paper in which Hibbs and I reported a study of 17 cases of Wilms tumors it was interesting to note the various histological diagnoses that had been made for instance multiple cell type sarcoma, myxomatous tumor, alveolar round cell sarcoma and myxomatous sarcoma and hypernephroma. A later histological study of these tumors showed that these diagnoses were in correct for the tumors so named belonged to

that interesting group—the mixed tumors. Bilateral mixed tumors are rare although we found 2 in our series.

The embryonal structure of these tumors is their most distinguishing feature. Both epithelial and connective tissue elements are present. The former are composed of small and large epithelial cell nests and embryonal tubules undifferentiated round cells and striated and non striated muscle fibers. Elastic tissue and fat may be present as well as cartilage and bone. Bone formation is rare however probably due to the fact that the patients die early and there is not sufficient time for bone formation.

Trauma probably plays a negligible role in the production of these tumors although a history of trauma was given in 3 of our cases.

Beer and Hyman quote the following theories concerning the pathogenesis of these malignant tumors as mentioned by Frazer.

1 That their origin is due to inclusion of wolffian body tissue which has become displaced and persists among the cells of the developing kidney or metanephros (Birch Hirschfeld).

2 That aberrant cells of the myotome and sclerotome are responsible for the tumor growth and that the apparent mixed cell character is to be explained by the varying constituents which enter into the ultimate formation (Wilms).

3 That these tumors are not due to inclusions from extrarenal sources but are derived from the embryonic tissue of the true kidney this tissue persisting and becoming metamorphosed into cellular structures of various types (Busse Muns Ewing).

Fourteen of our patients were males and only 3 were females. In the series of Beer and Hyman 10 were males and 7 females. Two of our patients were under 6 months of age the oldest 6½ years.

Among the general symptoms noted may be mentioned fever abdominal pain loss of appetite and weight and irritability.

The one constant symptom is an enlargement of the abdomen which is often discovered by the mother or nursemaid. When first noted the swelling is generally of large size a fact which indicates that the tumor

indwelling catheter. In my series of cases in which uroselectan was used there was one case in which wrong conclusions were reached from the reading of the urograms. This case will be discussed in detail under differential diagnosis.

Cystoscopy and ureteral catheterization. The last steps in the examination are cystoscopy, ureteral catheterization, pyelography and the bacteriological study of the separated urines as well as a very careful study of the renal function. It may be advisable in certain cases to defer pyelography for a subsequent examination.

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CASE ILLUSTRATING IMPORTANCE OF CORRECT INTERPRETATION OF FILMS

Bilateral carcinoma of the ovaries

CASE 1: E. C. female aged 3 years 9 months referred by Dr. Charles Schott. She was admitted to the Children's Memorial Hospital July 21, 1930. Ten months before admission to the hospital the mother noticed that the child was extremely pale, was losing weight, ate very little, was very irritable and the abdomen looked larger than usual. Several weeks later the mother noticed a rapid enlargement of the abdomen which was much more noticeable on the right side. There was some frequency; the child had to urinate three or four times at night. Before admission to the Children's Hospital the child had been in another hospital where an injection of uroselectan had been made; on the left side the pyelogram was normal and on the right side no kidney shadow was seen. A diagnosis of tumor of the right kidney was made. The patient was then sent to the Children's Hospital.

Physical examination disclosed a very prominent abdomen, fluid in the peritoneal cavity, a hard, fixed, nodular mass in the right side and enlarged inguinal glands. Wasse mann test gave a negative reaction. Blood examination showed red blood cells 3,200,000, leucocytes 8,400, hemoglobin 58 per cent. Blood chemistry: uric acid 5.7, creatinine 1.8, non protein nitrogen 45.7.

Urinalysis: albumin 0, blood 0, sugar 0, many hyaline and a few granular casts. Cystoscopic examination was negative. The ureters were catheterized without difficulty or obstruction. The specimens of urine obtained from the right and left kidneys and bladder were negative and sterile upon culture. The pyelograms, right and left, were normal.

Diagnosis: primary ovarian tumor with metastases to the liver.

Result: the child failed very rapidly and died ten days after admission to the hospital. Autopsy examination was made by Dr. W. G. Hibbs whose findings were bilateral carcinoma of the ovaries.

Problems in differential diagnosis may arise in cases of appendicitis for instance when an appendiceal abscess is adherent to the bladder and produces bladder symptoms that predominate the clinical picture or when in

practically the whole of the left side of the abdomen. A small nodular mass was felt just to the left of the umbilicus. Urinalysis reaction acid albumin + sugar 0 sediment negative. Blood examination red blood cells 6,330,000 leucocytes 18,480 hemoglobin 60 per cent. Wassermann test was negative. Cystoscopic examination revealed a normal bladder. Urine from the right kidney was normal; no urine was obtained from the left kidney. Pyelograms were made and revealed a normal right side. On the left side the bromide solution met an obstruction at the ureteropelvic junction; hence no pyelogram was obtained.

A left nephrectomy was done. Sections were made and showed a mixed tumor (Wilms). Since leaving the hospital the patient has had two courses of deep X-ray treatment and is still living and well.

TUBERCULOSIS OF THE KIDNEY

During infancy and childhood chronic renal tuberculosis is rare. A study of the literature reveals this fact and I have found it to be true in my experience. I have seen but 8 cases of renal tuberculosis in children up to the age of 14 years. Five of these children were operated upon. In a series of 335 cases (operated upon) Kuster reports that 1.49 per cent occurred in children from 1 to 5 years old and in a group from 5 to 10 years old he found 1.49 per cent. Guillon reported 60 nephrectomies from the Albarran service and found 5 per cent under the age of 20. In his thesis Boeckel published the statistics of Andre. In this series of 64 nephrectomies there were 4 cases or 6.25 per cent under 19 years. Wildbolz found 1.26 per cent under the age of 10 years.

I believe that there is slight doubt but that the figures on the frequency of renal tuberculosis in children will undergo revision in the near future when all cases of chronic pyuria and so called relapsing pyelitis will be subjected to more careful and complete urologic study. A more painstaking comprehensive urologic study will likewise throw light on another debatable point that is whether the involvement is unilateral or bilateral.

The problem of diagnosis will not be difficult provided careful examination is made of every case of pyuria or hæmaturia as well as of every case with persistent bladder symptoms. However one should keep uppermost in his mind the possibility of the presence of renal tuberculosis in all cases that fail to respond

to medical treatment for chronic pyuria. Routine X-ray examination of the urinary tract will often show areas of calcification compatible with renal tuberculosis—a phase of the diagnosis in renal tuberculosis ably presented by Braasch some years ago.

The problem is just the same in children as it is in the adult; namely to determine which side is involved and the functional capacity of the well side. In the early cases cystoscopic examination may show nothing abnormal. However many patients are not seen until the condition has been present a long time so that the bladder has already become more or less involved and changes have taken place which are readily recognized by the well trained urologist when the patient is subjected to cystoscopic examination.

It is surprising to note that many European urologists consider that it is difficult to diagnose this lesion and to determine whether or not the lesion is bilateral or unilateral. They attribute this problem to the difficulty of passing the cystoscope. Mathieu states that under 8 or 10 years of age catheterization very often seems impracticable so that it is his custom to perform an exploratory operation in the lumbar region. However with the present highly perfected small cystoscope the field of applicability of cystoscopy and ureteral catheterization must ever widen. Even in small boys in whom only small instruments can be introduced one is justified in some cases in catheterizing and studying one side at a time. This technical difficulty may be still further reduced by using uroselectan. Once the diagnosis of chronic unilateral renal tuberculosis has been made provided the opposite kidney is free of tuberculous disease a nephrectomy would be the proper course to pursue.

ILLUSTRATIVE CASES OF RENAL TUBERCULOSIS

Renal tuberculosis—right

CASE 4. F. B. female aged 9 years was admitted to the Presbyterian Hospital on the service of Dr. C. Grullee October 4, 1930. For the past month the patient had been voiding small amounts of urine at frequent intervals and had been obliged to rise from four to six times at night to void. This was not associated with much pain although at present there is some burning upon urination. Physical examination was negative except for a slight tenderness in the

has been present for some time hence it is exceedingly difficult to determine the duration of the patient's illness. The rate of growth of these tumors may be said to be rapid probably in most of the cases. Death is generally due to cachexia metastases and occasionally to intercurrent infection.

Hæmaturia so common in malignant disease in the adult is singularly uncommon in the child. In only one of our 17 cases was blood reported in the urine and there was some doubt about this. Microscopic blood was found in some of them.

Since many of these patients come in late in the course of the disease the diagnosis is relatively easy. The presence of a large unilateral tumor often of enormous size which may or may not show an irregular nodular surface which has had a more or less rapid growth the presence of *anæmia* loss of appetite and weight all are positive signs that should safely guide us toward making a correct diagnosis. A plain roentgenogram will often reveal the outline and the extent of the tumor. The value of intravenous pyelography is evident. As a rule cystoscopy and ureteral catheterization are carried out last in the routine examination so as to determine the presence and functional capacity of the opposite kidney and to make bacteriological studies of the urine.

Metastases occur in the liver and in the lung. Extension metastasis may occur throughout the entire abdomen the growth involving the viscera and completely enclosing such structures as the pancreas and suprarenals. Metastasis to the opposite kidney has been noted. Extension through the diaphragm may occur in which case tumor nodules are found on the pleural surface of the diaphragm.

ILLUSTRATIVE CASES OF MALIGNANT TUMOR OF THE KIDNEY

Malignant tumor of the kidney

CASE J B male aged year was admitted to the Presbyterian Hospital July 17 99 with complaint of enlargement of the abdomen and tumor mass on the right side. Six weeks before admission to the hospital mother while thinking the child noticed this enlargement of the abdomen. There had been no pain or urinary symptoms. Physical examination was negative except for a large

tumor in the right upper quadrant which extended from the arch of the rib down to the crest of the ilium. The mass was firm smooth elastic and freely movable. Blood examination showed red blood cells 4 000 000 leucocytes 16 200 hæmoglobin 68 per cent Wassermann and Kahn tests were negative. Blood chemistry urea nitrogen 23.4 uric acid 5.0 creatinine 2.1 total non protein nitrogen 41.7. Urinalysis reaction acid sugar 0 albumin + blood 0 sediment 0. Roentgen ray examination disclosed a uniform dense shadow over the right half of the abdomen. Cystoscopic examination disclosed a normal bladder the urine from the left kidney negative. A left pyelogram was normal. The right pyelogram showed the ureter displaced to the left side of the abdomen. No fluid entered the kidney pelvis.

On July 21 1929 under ether anesthesia a right nephrectomy was done. Following the operation the child developed complete anuria. The blood chemistry was urea nitrogen 100 uric acid 9.1 creatinine 4.3 total non protein nitrogen 128.9. The anuria was relieved by ureteral catheter drainage. Following the removal of the catheter the patient again developed anuria. The blood chemistry at this time showed 133 milligrams of urea nitrogen.

On July 29 1929 a second operation was done consisting of pyelotomy and decapsulation. The kidney was normal and free of tumor. The patient left the hospital 2 days after the operation.

On September 3 1929 he was admitted to the hospital a second time. Two weeks prior to this the presence of a mass in the left upper quadrant had been noticed by the parents. On September 4 1929 under ether anesthesia a third operation was performed. At this operation was found a large malignant tumor involving the remaining kidney. Sections were removed and microscopic examination revealed the presence of mixed tumor cells that corresponded with the structure in the sections that were made from the kidney removed from the opposite side 2 months ago. The patient left the hospital October 18 1929. He was given deep X-ray treatments but failed rapidly and died on December 2 1929.

Autopsy showed the presence of a Wilms tumor in the remaining kidney.

Malignant tumor of the kidney

CASE 3 L J W female aged 13 months was admitted to the Children's Memorial Hospital on the service of Dr. Joseph Brennemann October 8 1928. The parents stated that the baby had always had a very large prominent abdomen and that this had been noticed since she was about 1 month old. No importance was attached to this enlargement until the child was 13 months old when they took her to the doctor because they believed that the abdomen was growing more rapidly than the rest of the body.

Physical examination as negative except for the presence of a large mass in the left side of the abdomen which was firm movable and occupied



Fig. 2 Case 6 Areas of calcification between first and second lumbar vertebra

Roentgen ray examination disclosed a group of small dense shadows at the second lumbar on the left side cast by calcified glands.

Cystoscopic examination showed areas of superficial ulceration of the bladder. The ureters were catheterized without difficulty or obstruction. Examination of the urine obtained at that time showed

| | Le p | St mm | Cl t | T b l | G o c l u f l | P s |
|--------------|------|---------|------|----------|---------------|-----|
| Bladder | 390 | Sterile | o | Positive | | |
| Right kidney | 80 | Sterile | o | Positive | | |
| Left kidney | 570 | Sterile | + | Positive | | |

Pyelogram of right side showed a normal pelvis. On the left side the pyelogram (Fig. 2 Case 6) showed a group of calcified glands in the middle of the kidney pelvis.

Result: no operation; patient died May 16, 1927.

URINARY CALCULI

Calculi in the urinary tract are relatively rare at least the number of cases reported is small. This supposedly rare incidence may be due to failure to recognize the stone since careful routine examinations in these little patients are not made for stone. It is possible that because of prominence of the gastrointestinal symptoms instances may be overlooked the patients being regarded as gastrointestinal cases. If because calculus

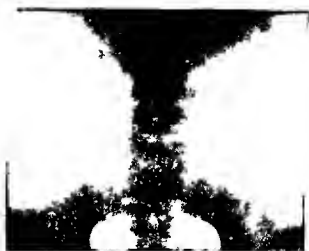


Fig. 3 Case 7 The presence of stone in the right kidney

disease is suspected careful routine examination of the urine is carried out. Changes in the urine would be found that would call attention to the possibility of a lesion in the urinary tract. In such case a complete urological study should be made to verify the diagnosis.

Thomas and Tanner in an article based on a questionnaire were able to collect 203 reports of urinary lithiasis in infants and children. The average age was 7.8 years. Forty of the total number occurred in children up to the age of 5 years, 60 in children between 5 and 10 years, and 58 between 10 and 15 years. In the 45 remaining cases the age was not given. There were 155 males and 45 females or a ratio of about 3 to 1. They found the following localization:

| | P t t | P C t |
|---------------------------|-------|-------|
| Right kidney | 21 | 10 |
| Left kidney | 8 | 39 |
| Right ureter | 7 | 34 |
| Left ureter | 8 | 39 |
| Bladder | 116 | 57 |
| Urethra | 25 | 12 |
| One kidney and one ureter | 9 | 4 |
| Both kidneys | 14 | 6 |
| Both ureters | 1 | |
| Both kidneys and ureters | 1 | |

Thomson reported a series of 585 cases of calculi of the urinary organs in which operation was performed. Thirty-eight per cent of the cases were children under 15 years of age, figures that no doubt are much higher than those in this country.¹

Clinton Smith found 5 cases—a relatively high incidence—in his series of 56 cases in

R p o t U m y C i l C t H p t a l C a t C h

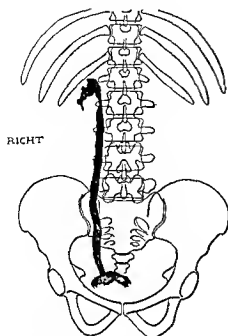


Fig. Case 4. A. P. I. a. outline of the kidney pelvis. The line might be confused with the normal form seen in a normal male.

suprapubic region and to the right and left of the subcostal regions. Urinalysis showed albumin + blood + pus + sugar + casts +. Blood examination showed red cells 4,480,000, leucocytes 4,250, hemoglobin 66 per cent.

Blood chemistry tests showed urea nitrogen 17.6, uric acid 4.3, creatinine 1.4, non-protein nitrogen 26.5. Blood Wassermann test was negative.

Cystoscopic examination revealed a few spots of ulceration in the region of the right ureter but the bladder was otherwise negative. The ureters were catheterized without difficulty or obstruction. Examination of urine obtained at that time showed:

| | Leucocytes | Cultures | Tubercle bacilli | Gonorrhea |
|--------------|------------|----------|------------------|-----------|
| | p | mm | b | f |
| Bladder | | | | |
| Right kidney | 7 | St. le | + | |
| Left kidney | | Sterile | o | |

Pyelograms were made and showed on the right side (Fig. 1, Case 4) the kidney pelvis irregular in shape opposite the second lumbar vertebra. The superior calyx was narrow and the margins were ragged. The upper ureter was within normal limits. The left pyelogram showed a normal pelvis.

Poentgen ray examination of the chest disclosed a circumscribed area of increased density over the left side of the heart.

Fluoroscopic examination of the chest disclosed a density within the lung indicating the presence of a tuberculous abscess. Patient was sent to a tuberculosis sanitarium.

Renal tuberculosis (right) and pulmonary tuberculosis

CASE 5. O. T. colored female aged 7 years was admitted to the Presbyterian Hospital on the service of Dr. C. Grulee February 15, 1928. The patient had been suffering from frequency of urination, nocturia, hematuria and dysuria for some weeks. These conditions had not been noticed until the child had wet the bed a number of times and had complained of pain on urination. During the past 3 weeks the symptoms had become more marked. There had been a discharge from the right ear for 4 years. Physical examination was negative except for a purulent discharge from the right ear, marked cervical adenopathy on the right side and small glands on the left. Urinalysis disclosed albumin + sugar + blood + casts + pus +. Blood examination showed red cells 5,460,000, leucocytes 7,300, hemoglobin 72 per cent.

Röntgen ray examination of the chest showed tuberculosis. Röntgen ray examination of the kidneys was negative for stone.

Cystoscopic examination revealed the presence of cystitis. The left ureter was catheterized without difficulty or obstruction and very purulent urine was obtained. The right ureter was catheterized but urine was obtained with great difficulty and on examination showed:

| | Leucocytes | Cultures | Tubercle bacilli | Gonorrhea |
|--------------|------------|----------|------------------|-----------|
| | p | mm | b | f |
| Bladder | 4560 | St. le | + | + |
| Right kidney | 2 | Sterile | | |
| Left kidney | 2320 | Sterile | + | + |

Von Pirquet test gave a positive reaction. The right pyelogram was normal.

On March 2, 1928, under ethylene anesthesia a left nephrectomy was done. The ureter was found to be slightly thickened, the kidney much enlarged with large tuberculous nodules on its surface. One tuberculous mass was as large as a plum.

Result uneventful recovery. Discharged from the hospital March 26, 1928.

Bilateral renal tuberculosis

CASE 6. R. W. male aged 14 years was admitted to the Presbyterian Hospital September 24, 1923. The previous history was negative. Nine months before admission to the hospital while ice skating patient's feet got wet after which he urinated every hour during the day for 3 weeks. The frequency varied and during the past 4 months he has been obliged to void every 2 hours. Urination was painful especially at the end of urination and was associated with a pressing sensation and a sensation of great straining. For the past months blood has been noted in the urine at the end of the act. Physical examination was negative. Blood examination revealed red cells 5,800,000, leucocytes 10,600, hemoglobin 90 per cent. Blood pressure systolic 18, diastolic 72.



Fig 5 Case 9 The presence of bilateral renal calculi. Note the light center in each stone.

had been under treatment in the out patient department for the presence of pus in the urine. Physical examination was negative. Urinalysis showed albumin ++++ blood 0 sugar 0. Microscopic examination showed many pus cells both free and in clumps. Cultures showed colon bacilli. Roentgen ray examination (Fig 4) revealed a shadow in the region of the pelvis of the right kidney.

Cystoscopic examination disclosed large flakes of pus adhering to the bladder mucous membrane. The ureters catheterized without difficulty or obstruction. Examination of the urine obtained at that time showed normal urine from the left kidney and 3,000 leucocytes and colon bacilli on culture from the right kidney. Blood chemistry showed normal blood. Under ether anesthesia a right pyelotomy was done March 29, 1928. A large stone was removed through the incision in the pelvis. A small aberrant vessel was found running to the lower pole of the kidney. Convalescence was uneventful and patient was discharged from the hospital April 19, 1928.

Bilateral renal calculi

CASE 9. E. S. female aged 12 years was admitted to the Children's Memorial Hospital August 13, 1929. Three years ago patient had a severe attack of pain in the right lower quadrant. The pain was severe and the attacks have increased in frequency and severity. Urination sometimes relieved the patient. The attacks were associated with chills, fever and vomiting and at times by frequency of urination. Physical examination was negative. Urinalysis showed reaction acid albumin ++ sugar 0 pus ++. Blood chemistry showed normal blood. Cystoscopic examination showed the bladder to be normal. The ureters were catheterized without difficulty or obstruction. Examination of urine obtained at that time showed



Fig 6 Case 10 The presence of a large stone in the left ureter.

| | Le | gt | re | Clt |
|--------------|------|----|----|----------------------|
| | mm | | | |
| Right kidney | 2080 | | | Staphylococcus albus |
| Left kidney | 810 | | | Staphylococcus albus |

Roentgen ray examination (Fig 5) revealed bilateral renal calculi. Under ether anesthesia on August 22, 1929 a bilateral pyelotomy with removal of the stones and decapsulation was done. Chemical examination of stones showed uric acid.

Convalescence was uneventful and patient was discharged from the hospital September 6, 1929.

Left ureteral stone

CASE 10. W. A. male aged 11 years. A previous urinary examination showed a large amount of pus. There were no urinary symptoms. Physical examination was negative. Blood examination showed red blood cells 5,168,000 leucocytes 26,000 hemoglobin 95 per cent. The Wassermann test gave a negative reaction. Urinalysis showed reaction acid albumin 0 blood 0 sugar 0 pus ++ tubercle bacilli 0. Roentgen ray examination showed a shadow extending from the second sacral foramen to the end of the sacrum (Fig 6). Cystoscopic examination revealed a normal bladder. A thick worm like cast of pus was seen protruding from the left ureteral orifice. The right side was catheterized without difficulty or obstruction and the urine obtained was clear and sterile upon culture. On April 7, 1923 under gas ether anesthesia a left ureterotomy was done. The ureter was found to be thickened, hard and fibrous. Stone was removed. Recovery uneventful.

Stone in ureter—right

CASE 11. N. N. female aged 8 years was admitted to the Presbyterian Hospital December 17, 1926. During the past year she had had severe attacks of pain in the right kidney region radiating downward and forward into the bladder. The attacks usually lasted about 3 to 12 hours and were associated with pain, nausea and vomiting. The present attack had begun 4 days before admission to

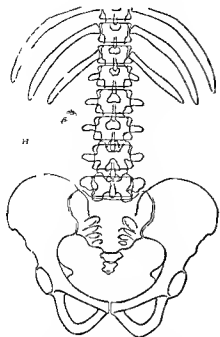


Fig 4 Case 8 As lithary stone in the right kidney

which complete urological study was made for symptoms relative to the urinary tract

In children the stone is found in the bladder in the great majority of cases. Bokay found the stone in the bladder in 150 out of 161 cases of urinary calculi in children (Thomson Walker)

Regarding the incidence of lithiasis in children Hager presents some very interesting data. In a series of 3295 cases of children under 15 years he found bladder stones in 11 of 674 or 1.63 per cent, ureteral stones in 7 of 813 or .86 per cent, and kidney stones in 15 of 1808 which is a relatively low incidence.

In the average case of kidney and ureteral stone the syndrome tallies closely with the picture presented by the adult except that it is often difficult to obtain a classical history in children and also because of the presence of gastro intestinal symptoms the urological symptoms are overshadowed hence overlooked. But repeated examinations of urine for the presence of blood cells and pus cells as well as crystals will give a clue to the real cause of the symptoms and this should be an incentive to careful urological study.

Pain is present in by far the largest number of cases. Renal colic and blood and pus in

the urine occur with renal and ureteral stone. In one child the only complaint was painless hematuria and yet examination disclosed calculi on both sides. In another instance the patient was sent in because albumin had been found in the urine. A diagnosis of nephritis had previously been made.

Calculi in the bladder of the child produce symptoms similar to those in the disease in the adult namely pain, frequency, urgency and tenesmus. At times there is a great urgency and great difficulty is experienced in holding the urine with the result that the child wets the bed at night and his clothes during the day. On account of these symptoms a diagnosis of enuresis is occasionally erroneously made and the usual treatment for enuresis is instituted with the result that one more patient is added to the list of failures to relieve the condition treated. In every case of enuresis we always make it a rule to subject the patient to an X-ray examination of the genito urinary tract and to a cystoscopic examination. We do this especially in that group which have been treated for enuresis for varying periods of time without relief.

The diagnosis and differential diagnosis should offer no problems not met with in the adult.

ILLUSTRATIVE CASES OF CALCULUS

Renal calculus

CASE 7 E. H. female aged 10 years was admitted to the Children's Memorial Hospital on the service of Drs. F. Sk. Helmholtz and Schott March 2, 1910. Eight months prior to admission to the hospital patient had had attacks of severe pain on the left side of the abdomen. The pain was aggravated by movement or exertion. At times these attacks occurred every day. No urinary symptoms were present. Physical examination was negative. Cystoscopic examination revealed a normal bladder. The ureters were catheterized without difficulty or obstruction. The urines from the right and left kidneys were free of pus and sterile upon culture. The bladder urine showed 11 pus cells per cubic millimeter. Luteal phase upon culture. Roentgen ray examination disclosed a stone in the left kidney about the size of a dime (Fig. 3). Permission to operate was refused.

CASE 8 M. M. female aged 9 years was admitted to the Children's Memorial Hospital on the service of Dr. Aldrich February 2, 1918. Chief complaint of frequency and painful urination. Patient

Renal calculus—girl

CASE 8 M. M. female aged 9 years was admitted to the Children's Memorial Hospital on the service of Dr. Aldrich February 2, 1918. Chief complaint of frequency and painful urination. Patient

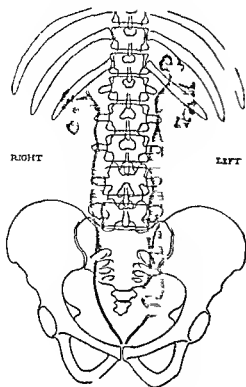


Fig 9 Case 15 Bilateral dilatation of ureters and kidney pelves

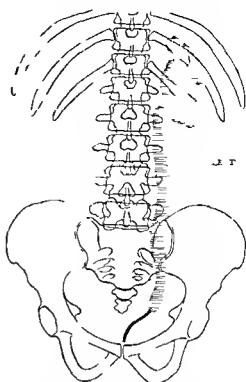


Fig 10 Case 17 (Left pyelo ram) The presence of enormous dilatation of the kidney pelvis and ureter

is proved by a study of the statistics of children's hospitals of the pediatric services of the large general hospitals and also of large out patient departments. The experience of various urologists as shown in their published reports also confirms this finding. Thomas and Birdsall found 14 cases (34 per cent) of pyelitis and pyelonephritis in a series of 48 renal lesions. Their figures closely resemble my own. In a previous paper I reported that in a series of 86 cases of urologic conditions in children, a diagnosis of pyelitis and pyelonephritis was made in 30 or approximately in 34.5 per cent.

The fact that these infections are so frequent and the fact that the various methods of treatment have given unsatisfactory results probably account for the extensive literature on the treatment of pyelitis.

The failure to effect cure through the various forms of treatment that have been and are still in use is due to the fact that the underlying pathology is not understood for the diagnosis is generally based on the symptoms especially on the presence of pus in the urine.

As a result of intensive study the old conception of the clinical picture of so called

pyelitis has completely changed and we are now in a position to appreciate why in one group of cases the disease runs an apparently self limited course and responds promptly to

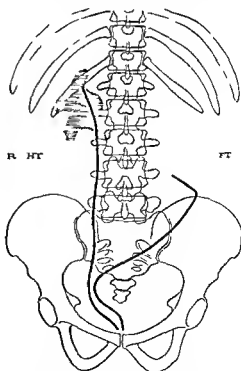


Fig 11 Case 18 (Right pyelogram) Hydronephrosis



Fig 7. Cystoscopic examination of the right ureter.

the hospital and the pain was still present. The pain generally subsided gradually and was followed by soreness in the right side. The attacks were brought on by riding on street cars and buses. Blood was found in the urine about 6 months ago.

Physical examination was negative except for some tenderness on the right side in the region of the right kidney. Urinalysis showed albumin + sugar, blood trace, sediment showed pus cells and many red blood cells. Blood examination showed red blood cells 5,510,000, leucocytes 17,200. Roentgen ray examination disclosed a shadow on the right side of the pelvis, a dense shadow (Fig 7) strongly suggesting a stone in the ureter. Cystoscopic examination revealed the right ureteral orifice swollen and edematous. The ureters were catheterized with some difficulty on the right side. Examination of urine obtained at that time showed no pus cells, no organisms, normal and sterile upon culture. A further roentgenogram at once (Fig 8) showed the presence of the stone in contact with the shadow of the catheter. A shift plate film showed the stone still in contact with the catheter and a dilated pelvis. A diagnosis was made of stone in the right ureter. On December 16, 1916, under ethyl ether anesthesia a right ureterotomy was done. Recovery was prompt and patient was discharged from the hospital January 19, 1917.

Bladder catheterism showed no pus cells, no organisms, normal and sterile upon culture.

CASE 12. H. H. male, colored, aged 35 years. Resident of Chicago. History of urinary tract disease since childhood. Patient had been suffering for 1 year with



Fig 8. Cystoscopic examination of the right ureter.

constant dribbling of urine associated with burning on urination. There had been difficulty in passing urine necessitating great straining for some length of time. Physical examination was negative except for the presence of a large suprapubic tumor. The Wassermann test gave positive reaction. Cystoscopic examination revealed a stone as well as edema and edness at the base of the bladder. The residual urine was 8 ounces. A diagnosis was made of stone in the bladder, chronic cystitis and fibrosis of internal urethral orifice. Operation was advised and consented to. A suprapubic cystostomy was made and the stone was removed. The internal urethral orifice was resected and the posterior urethra dilated with the finger. Patient made an uneventful recovery.

ACUTE AND CHRONIC INFECTIONS OF THE KIDNEY

It is a generally well recognized fact among pediatricians and urologists that the disease most frequently found in the urinary tract of infants and children is that presenting the clinical picture of pyelitis or cystopyelitis. That this clinical picture is frequently present

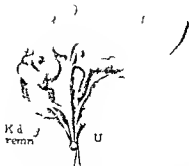


Fig. 2. C. 19 (Infant aged 3 months). The pelvis of the kidney is dilated with multiple cysts. The ureter is dilated with multiple cysts.

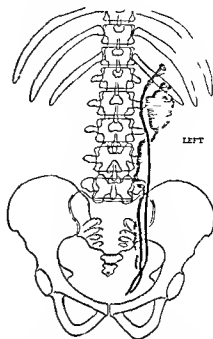


Fig. 3. C. 19 (Infant aged 3 months). The pelvis of the kidney is dilated with multiple cysts. The ureter is dilated with multiple cysts.

internal treatment while in another group there is no response to any sort of internal treatment. The one factor that has contributed more than any other to the understanding of these cases is the pyelo uretero gram through which is shown the important role played by stasis and faulty drainage and the frequency with which hydronephrosis and hydroureter occur.

In this group of cases the colon bacillus is the common invading organism but by no means the only one. Other organisms found are as follows: staphylococcus albus, staphylococcus eberthella group, streptococcus streptococcus haemolyticus, salmonella group, pyocyanus and pneumonococcus.

Discussion is still rife as to the relationship between pyelitis and the infections of the nose and throat which are often classified under grippe. The grippe infections are generally due to organisms of the coccal group whereas in pyelitis the colon bacilli are found. Some claim that the colon bacillus overgrows the other organisms so that an erroneous impression is given. This phase of the subject is still open to investigation and discussion.

I will not burden you with a discussion of the various theories concerning the route or path of infection but will simply say that they are three in number and are designated as urogenous, lymphogenous or haematogenous.

As previously mentioned there seem to be two groups of cases. In the first group the disease apparently runs a self limited course the patients get well with or without medical treatment and no difficult problem is presented. In the second group of cases there is a history of few or many recurring attacks of acute pyelitis with its symptoms of chills, fever, sweats and often great prostration. Gastro intestinal symptoms are occasionally present. When the acute attack subsides the urine seldom clears up entirely and even when it clears as occasionally happens, colon bacilli are nevertheless found on culture. In the group of relapsing cases and even in some cases in which there has been only one attack of pyelitis the examination of urine often shows the presence of pus or colon bacilli or both. When medical treatment fails in this group of cases the patient should be subjected to a complete urological study. A more or less arbitrary period of time should be fixed beyond which it should be considered unwise to carry internal treatment without a definite knowledge of what the underlying pathology might be. I believe that in the ordinary case of acute

without difficulty or obstruction Examination of urine obtained showed the following

| | Leuocytes per c mm | Cultures |
|--------------|--------------------|----------------|
| Bladder | 230 | Colon bacillus |
| Right kidney | 1040 | Colon bacillus |

Pyelogram of right side showed the kidney pelvis at second lumbar and within normal limits The ureter appeared normal

TREATMENT CASE 14

| D t | Leuocytes per c mm | | Cultures | | T c m t |
|--------|--------------------|-------|-------------|-------------|--|
| | Right | Bl dd | Right | Bl dd | |
| 6-14 8 | 4 | 3 | C l n b ill | Col n ba ll | |
| 6-20 8 | 4 | 7 | Col n b ill | C l n b ill | 3 m ^{cr} Agn 3 int right k d y |
| 6-27 8 | 160 | 3 | Col b ill | C l b ill s | 3 m ^{cr} Agn 3 t ght kid y |
| 7 6-8 | 3 | 4 | St ril | St il | 4 m ^{cr} Agn 3 at ght k d y |
| 8-28 8 | | | Ster l | St l | 5 m ^{cr} Agn 3 t ght k d y |

Result free of symptoms 8 months later with negative urinary examination

Bilateral ureteral strictures hydronephrosis and pyelitis

CASE 15 P C female aged 5 years was admitted to the Children's Memorial Hospital on the service of Dr Aldrich June 5 1918 The child had been perfectly well up to 1 year ago at which time pus was found in the urine Internal treatment had been given Physical examination was negative Blood examination showed red cells 4 040 000 leucocytes 16 800 hemoglobin 75 per cent The systolic blood pressure was 106 diastolic 80 Blood chemistry analysis showed urea nitrogen 17 uric acid 3.0 creatinine 2.4 non protein nitrogen 33 Urinalysis showed albumin + sugar o blood o pus + Roentgen ray examination was negative for stone

Cystoscopic examination revealed small cysts on the trigone possibly cystitis cystica The ureters were catheterized without difficulty or obstruction and examination of the urine obtained showed

| | Leucocytes per c mm | Cultures | T b l |
|--------------|---------------------|-----------------------------------|-------|
| Bladder | 1395 | Colon bacillus | o |
| Right kidney | 195 | Colon bacillus and staphylococcus | o |
| Left kidney | 405 | Colon bacillus | o |

Pyelograms (Fig 9) showed dilatation of both ureters and kidneys

Treatment consisted in dilatation of the ureteral strictures and pelvic lavage with silver nitrate Eight dilatations and eight pelvic lavage treatments

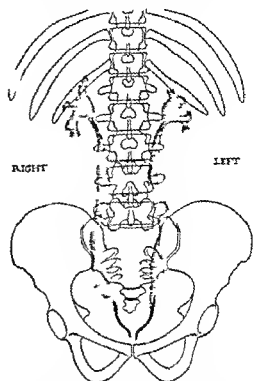


Fig 16 Case 4 Bilateral ureteral strictures hydronephrosis and hydronephrosis

gave no improvement as regards the dilatation of the strictures Operation was advised On October 25 1918 a suprapubic cystostomy was done Both strictures were dilated beginning with a No 8 French bougie Bougies of increasingly larger sizes were used up to a No 18 French sound which was passed without any trouble

Result patient made an uneventful recovery and left the hospital much improved Subsequently she was given seven treatments of ureteral dilatation and pelvic lavage with silver nitrate

Right hydronephrosis stricture of right ureter and bilateral pyelitis

CASE 16 P E female aged 4 years referred by Dr W W Ross LaPorte Indiana was admitted to the Presbyterian Hospital September 15 1925 Patient had had a light attack of measles 4 months ago Two weeks later she began having frequency burning on urination and pain in the region of the right kidney The temperature at this time was as high as 103 degrees During the height of the fever there was little or no pus present in the urine but directly the fever subsided examination of the urine showed many pus cells She has had four such attacks during the past 4 months the 2 last being more severe than the previous ones Physical examination was negative Urinalysis showed albumin o blood o sugar o pus + occasional granular casts Blood examination showed red cells 5 100 000 leucocytes 15 000 hemoglobin 90 per cent Blood chemistry analysis showed urea 35 uric acid 3.0 creatinine 1.25 non protein 32

influencing the dilatation materially if at all. In several instances in which the patient had definite stricture of the ureter at the uretero-pelvic junction systematic ureteral dilatation seemingly had no effect on the dilatation or infection.

It would seem that when dilatation and pelvic lavage have no effect on the patient's condition one is justified in advising surgery. This has been my course in a certain number of cases of stricture at the ureterovesical junction. The operation consists in a supra-pubic cystotomy and division of the strictured area with scissors through the open bladder followed by dilatation of the ureteral stricture with ordinary urethral sounds. If the kidneys are to be saved I believe one is justified in advising surgery for in my experience the patients I operated upon had been very thoroughly and conscientiously treated with dilatation without effect in one case five ureteral catheters had been introduced but even this degree of dilatation had had no influence upon the patient's condition.

Many cases of stricture of the ureter have been reported as congenital in origin. No doubt in a certain number of cases this is true particularly in young children for large hydronephroses have been found in the newborn but whether one is justified in classifying all strictures in children as congenital may be open to some discussion.

ILLUSTRATIVE CASES OF ACUTE AND CHRONIC INFECTIONS OF THE KIDNEY

Bladder and chronic nephritis and pyelitis

CASE 13. M. McN. female aged 13 years referred by Dr. George Parke. Was admitted to the Presbyterian Hospital August 6, 1929. At age of 26 months patient had a streptococcal throat infection followed by nephritis. Tonilectomy performed at that time. About 6 months ago edema of lower extremities, eyes and lips as noted. One month ago pus as found in the urine. For the past 2 weeks there has been some urgency and the urine can be retained only with much discomfort. Physical examination as negative. Urinalysis showed albumin + blood + hyaline and granular casts + blood in urine. Sediment showed 4000-5000 leucocytes, 3-800 haemoglobin, 80 per cent. The vaginal blood pressure 134 diastolic 76. Blood chemistry showed urea nitrogen 9.4, urea acid 7.3, creatinine 9.0, protein nitrogen 34.1. The Wassermann test was negative.

Cystoscopic examination showed a normal bladder and ureteral orifices. The ureters were catheterized without difficulty or obstruction. Examination of the urine obtained at that time showed the following:

| | Leucocytes/mm | Cultures | Testes |
|--------------|---------------|------------------|--------|
| Bladder | 00 | St. phyllococcus | lb s |
| Right kidney | 220 | Staphylococcus | alb |
| Left kidney | 35 | St. l. | |

The guinea pig test showed the urine from the bladder and from the right and left kidneys negative for tuberculosis.

The phthalein test showed a return in the first half hour of 20 per cent, in the second half hour of 9 per cent, and in the third half hour of 5 per cent, a total in 1 1/2 hours of 43 per cent.

TREATMENT CASE 13

| D | Leucocytes/mm | | | Cultures | | | Testes |
|-------|---------------|-------|------|-------------|-------|-------------|---------------------|
| | Bladder | Right | Left | Bladder | Right | Left | |
| 8-3-9 | 5 | 5 | 5 | Col. b. l. | S. l. | C. l. b. l. | er. l. t. bk. l. y. |
| 8-2- | 35 | | 5 | C. l. b. l. | S. l. | S. l. | er. l. t. bk. l. y. |
| 9-6-9 | 5 | 84 | | S. l. | S. l. | S. l. | er. l. t. bk. l. y. |
| | 45 | 9 | NSF | S. l. | S. l. | S. l. | er. l. t. bk. l. y. |
| 10-9 | | 75 | 5 | S. l. | S. l. | S. l. | er. l. t. bk. l. y. |

Result examination by Dr. Parker September 19, 1930, revealed a normal blood chemistry and a normal urine except for a trace of albumin and a few hyaline and granular casts.

Pyelitis—right

CASE 14. M. O. female aged 5 years was admitted to the Presbyterian Hospital on the service of Dr. C. Grulee June 1, 1928. A left nephrectomy had been performed at the age of 5 months because of an infected hydronephrosis. Following an attack of chicken pox 6 months ago the child continued to run a temperature and on examination pus was found in the urine for which she received treatment in the hospital. Upon admission to the hospital at that time pus was again found in the urine. Physical examination was negative. Urinalysis showed albumin, sugar, red blood corpuscles + + +. Blood examination revealed red cells 4,330,000, leucocytes 9,700, haemoglobin 60 per cent. The blood chemistry analysis showed urea nitrogen 5.4, uric acid 4.4, creatinine 1.5, non-protein nitrogen 36.4.

Cystoscopic examination June 14, 1928, revealed a normal bladder. The right ureter was catheterized

revised due to the fact that interest in this subject is increasing and many more cases will doubtless be reported in the near future. The pathologists especially those connected with children's hospitals being more interested in the matter than some years ago will undoubtedly report the results of their studies.

In a series of 133 consecutive necropsies on children Bigler found an incidence of 13 per cent of congenital anomalies of the urinary tract. Bugbee and Wollstein found anomalies in 23 per cent in a study of 4003 autopsies. Brown and Corbelle in a study of the urinary tract of 80 fetuses and young infants found malformations of the kidney in 20 per cent and malformations in the ureter in 11.25 per cent. In their series of 80 cases there were 3 cases of hydrocephalus and each of these showed definite kidney and ureteral deformities.

Further evidence of the frequency of the occurrence of these anomalies has been found in some of the recent publications. For instance Lowsley and Butterfield in a series of 100 cases of urological conditions in infancy and childhood found 29 instances of congenital anomalies, 13 of which were of such a nature that they probably influenced an infection of these organs. Beer and Hyman in reporting a series of 150 urological conditions in children found one third due to anomalies.

Mertz in a paper based on 49 cases of chronic pyuria in infancy and childhood found congenital changes in 20 or 40 per cent.

Except in very obvious cases such as a very large congenital hydronephrosis found on physical examination or in cases of ectopic ureters that open into the urethra or vagina the diagnosis is made during the course of routine urologic study. Even in cases in which both ureters open into the urethra and can be seen with the eye it is necessary to subject the patient to a complete cystoscopic examination. The type of anomaly in which both ureters open into the urethra without accessory ureters opening in the bladder is rare. Heaney and I reported a case belonging to this group in which both ureters opened into the urethra.¹

The mere fact that an anomaly is present should not lead one into believing that symptoms will occur on account of the anomaly itself as a rule symptoms are completely absent and on account of their absence the anomaly I regret to state is frequently overlooked. On the other hand congenital anomalies not infrequently produce interference with urinary drainage so that stasis results and sooner or later secondary infection intervenes. The infection it should be emphasized here is accompanied by chills and fever and pus in the urine and medical management has no effect on the condition. It is these factors which result in bringing the patient to the urologist.

It is not my intention to discuss all the congenital anomalies which may occur but I will present brief reports of some of the cases that I have seen. In some of the cases of stricture and hydronephrosis it may be difficult to arrive at the conclusion of a congenital origin of the lesion but in others the congenital origin is self evident.

ILLUSTRATIVE CASES OF CONGENITAL ANOMALIES

Congenital solitary cyst of the kidney

CASE 19 J H C female aged 3 months referred by Dr. Parmelee was admitted to the Presbyterian Hospital October 4, 1930. Off and on since birth the child had been troubled with vomiting and diarrhea. She had failed to gain weight. Three weeks ago the mother noticed an enlarged abdomen. No urinary symptoms were noted. Physical examination by Dr. Parmelee was negative except for a very thin distended abdomen. Peristaltic waves of stomach and loops of bowel were seen through the thin abdominal wall. A firm rounded tumor mass the size of a small orange and slightly tender to pressure was noted in the region of the right kidney. The mass extended down nearly to the crest of the ilium. With the use of uroselectan pyelograms were made. On the left side the pyelogram was normal. No pyelogram was obtained in the right side. Blood examination revealed red blood cells 3,600,000, leucocytes 13,500, hemoglobin 10 per cent. Urinalysis showed reaction acid, albumin 0, blood 0, sugar 0, few epithelial cells.

Diagnosis: Tumor of right kidney probably malignant and operation advised.

On October 22, 1930 under ether anesthesia a right nephrectomy was done. When the kidney was exposed a large cyst the size of a lemon was found (Fig. 12). This cyst was firmly attached to the lower pole of the kidney and several other cysts were seen.

Cystoscopic examination revealed a normal bladder and ureteral orifices. No urine was obtained from the right side. Examination of urine from left kidney showed 600 leucocytes per cubic millimeter cultures were sterile. A pyelogram of the right side showed the kidney pelvis at a level with the third lumbar vertebra. The pelvis was large. The ureter was definitely dilated and tortuous from the curve to the midline of the spine. A pyelogram of the left side showed the kidney pelvis at a level with first and second lumbar vertebrae and within normal limits and a very slight dilatation of the ureter the slightness of which is apparently of negligible importance. Treatment consisted in internal medication and pelvic lavage with silver nitrate.

Urinalysis September 2 1925 showed

| | Leucocytes per mm | Cult |
|-------------|-------------------|---------|
| Bl dde | | St rile |
| Rght k d ey | 3 | Steril |
| Lft k d ey | 60 | St 1 |

Result cured

Bilateral hydro-eter hydronephrosis pronephrosis and left ureteral stricture

CASE 7 E D male aged 9 years was admitted to the Children's Memorial Hospital on the service of Dr Baekman May 1 1927. Child was apparently well up to about 1 year ago. He now complained of pain in abdomen difficulty of urination and tenesmus. He has been losing weight appetite is very poor. Physical examination revealed an anæmic poorly developed and poorly nourished child not acutely ill. The tonsils were large cryptic and injected. Examination of the heart revealed faint systolic murmur at the apex. The abdomen was of the tense type with very thin wall and prominent veins. Peristaltic waves were visible through the abdominal wall. The external genital were negative except for marked phimosis. Urinalysis showed albumin ++ blood o sugar o pus + casts o.

Blood examination revealed cells 4,230,000 leucocytes 15,000 hæmoglobin 60 per cent. The systolic blood pressure was 4 diastolic 80. The Wassermann test of the spinal fluid was negative. Cystoscopic examination was made under ether anesthesia July 20 1927. A shelf could be seen behind the interureteric ligament and a few dimples behind and to the right of the right ureteral orifice. Large flakes of pus adhered to the bladder wall. Both ureters were catheterized and examination of the urine obtained showed

| | Leucocytes per mm | Cult | Gonorrheal bacteria |
|-------------|-------------------|----------------|---------------------|
| Bl dde | 460 | St phylococci | lb |
| Rght k d ey | 00 | St phyl c cusi | lb |
| Lft k d ey | 600 | St phyl c cusi | lb |

Residual urine was 125 cubic centimeters.

Pyelogram of the left side (Fig 6) showed enormous dilatation of the ureter and kidney pelvis of the right side dilatation of ureter and kidney pelvis.

Treatment The patient was carried along with catheter drainage and bladder irrigations for 5 months. On March 29 1928 under ether anesthesia operation was performed through a suprapubic cystostomy. The bladder was examined. The wall was thickened. A shelf was seen across the base at the bladder neck. The right ureteral orifice was not found. Two superficial diverticula were seen to the right of the usual normal location for the right ureteral orifice. The left ureteral orifice was dilated with Nos 6 8 and 12 (English) bougies and cut upward for 3/4 inch. A wedge shaped piece of tissue was removed from the base of the bladder neck. A No 18 urethral sound was passed.

Result uneventful convalescence. Patient was discharged from the hospital June 26 1928.

Bilateral hydro-nephrosis

CASE 18 D J a male aged 11 years was admitted to the Children's Memorial Hospital on the service of Dr J Brenneman February 16 1928. The child's abdomen had been large since birth. There were no symptoms. The child had always been well. Physical examination was negative except for the abdomen. Dr Brenneman found that on the right side deep seated and extending from about an inch below the costal border nearly to the brim of the pelvis was a hard nodular cordlike mass that was freely movable and did not protrude far into the abdomen. The child was admitted to the hospital a second time on June 26 1928 at which time examination showed the mass to be larger and softer. Urinalysis disclosed albumin o sugar o blood o pus +. Blood chemistry analysis showed urea nitrogen 14 uric acid 2.9 creatinine 1.4 non protein nitrogen 31. Cystoscopic examination revealed a normal bladder. The ureters were catheterized without difficulty or obstruction. The urine obtained at that time showed

| | Leucocytes per mm | Cultures |
|-------------|-------------------|---------------|
| Bl dde | 4445 | Staphylococci |
| Lft k d ey | 45 | Steril |
| Rght k d ey | 1 | Steril |

Pyelograms revealed bilateral hydro-nephrosis (Fig 11 right pyelogram).

On July 17 1928 under ether anesthesia a right nephrectomy was done. There was an enormous hydronephrosis and no kidney tissue was left.

Result uneventful recovery. Patient was discharged from the hospital August 14 1928.

CONGENITAL ANOMALIES

It is generally assumed that congenital anomalies of the genito-urinary tract in infants and children are rare due to the fact that such anomalies may cause no symptoms. Although this assumption is based upon past experiences there can be no doubt that the present statistics will of necessity have to be

revised due to the fact that interest in this subject is increasing and many more cases will doubtless be reported in the near future. The pathologists especially those connected with children's hospitals being more interested in the matter than some years ago will undoubtedly report the results of their studies.

In a series of 153 consecutive necropsies on children Bigler found an incidence of 13 per cent of congenital anomalies of the urinary tract. Bugbee and Wollstein found anomalies in 23 per cent in a study of 4903 autopsy reports. Brown and Corbelle in a study of the urinary tract of 80 fetuses and young infants found malformations of the kidney in 20 per cent and malformations in the ureter in 25 per cent. In their series of 80 cases there were 3 cases of hydrocephalus and each of these showed definite kidney and ureteral deformities.

Further evidence of the frequency of the occurrence of these anomalies has been found in some of the recent publications. For instance Lowsley and Butterfield in a series of 100 cases of urological conditions in infancy and childhood found 29 instances of congenital anomalies, 13 of which were of such a nature that they probably influenced an infection of these organs. Beer and Hyman in reporting a series of 150 urological conditions in children found one third due to anomalies.

Mertz in a paper based on 49 cases of chronic pyuria in infancy and childhood found congenital changes in 20 or 40 per cent.

Except in very obvious cases such as a very large congenital hydronephrosis found on physical examination or in cases of ectopic ureters that open into the urethra or vagina the diagnosis is made during the course of routine urologic study. Even in cases in which both ureters open into the urethra and can be seen with the eye it is necessary to subject the patient to a complete cystoscopic examination. The type of anomaly in which both ureters open into the urethra without accessory ureters opening in the bladder is rare. Heaney and I reported a case belonging to this group in which both ureters opened into the urethra.¹

The mere fact that an anomaly is present should not lead one into believing that symptoms will occur on account of the anomaly itself as a rule symptoms are completely absent and on account of their absence the anomaly I regret to state is frequently overlooked. On the other hand congenital anomalies not infrequently produce interference with urinary drainage so that stasis results and sooner or later secondary infection intervenes. The infection it should be emphasized here is accompanied by chills and fever and pus in the urine and medical management has no effect on the condition. It is these factors which result in bringing the patient to the urologist.

It is not my intention to discuss all the congenital anomalies which may occur but I will present brief reports of some of the cases that I have seen. In some of the cases of stricture and hydronephrosis it may be difficult to arrive at the conclusion of a congenital origin of the lesion but in others the congenital origin is self evident.

ILLUSTRATIVE CASES OF CONGENITAL ANOMALIES

Congenital solitary cyst of the kidney

CASE 19 J H C female aged 3 months referred by Dr. Parmelee was admitted to the Presbyterian Hospital October 4, 1930. Off and on since birth the child had been troubled with vomiting and diarrhea. She had failed to gain weight. Three weeks ago the mother noticed an enlarged abdomen. No urinary symptoms were noted. Physical examination by Dr. Parmelee was negative except for a very thin distended abdomen. Peristaltic waves of stomach and loops of bowel were seen through the thin abdominal wall. A firm rounded tumor mass the size of a small orange and slightly tender to pressure was noted in the region of the right kidney. The mass extended down nearly to the crest of the ilium. With the use of uroselectan pyelograms were made. On the left side the pyelogram was normal. No pyelogram was obtained in the right side. Blood examination revealed red blood cells 3,620,000, leucocytes 13,500, hemoglobin 70 per cent. Urinalysis showed reaction acid, albumin 0, blood 0, sugar 0, few epithelial cells.

Diagnosis Tumor of right kidney probably malignant and operation advised.

On October 22, 1930 under ether anesthesia a right nephrectomy was done. When the kidney was exposed a large cyst the size of a lemon was found (Fig. 12). This cyst was firmly attached to the lower pole of the kidney and several other cysts were seen

in the kidney. Although it was possible to resect the cyst it was decided to do a nephrectomy because of the presence of the other small cysts in the kidney.

Result: patient developed bronchopneumonia and died November 15 1930

Double kidney—left—with double ureter terminating in the bladder strictures of ureters and hydronephrosis

CASE 20 A B female aged 10 years was admitted to the Children's Memorial Hospital on the service of Drs Kaufman and Williams August 7 1929. For the past 6 years she had had many attacks of pyelitis and bronchitis for which she had received treatment. Pus had been present in the urine almost constantly. There had been some frequency of urination and loss of appetite. Physical examination was negative. Urinalysis showed albumin ++ pus +++ Blood chemistry analysis showed urea nitrogen 16 uric acid 3 creatinine 1.3 non protein nitrogen 35. Blood examination revealed red cells 4,100,000 leucocytes 12,400 haemoglobin 85 per cent. Roentgen ray examination was negative for stone. Cystoscopic examination revealed two left ureteral openings the upper one oedematous swollen and gaping the lower one normal. Both were catheterized. The right ureteral orifice was normal. The urine obtained at that time showed

| | Leucocytes per mm | Cultures | Urine |
|------------|-------------------|------------|-------|
| Bladder | 4 | Coliforms | 0 |
| Low left | 35 | Strep | 0 |
| Upper left | 35 | Strep | 0 |
| Right | | Clostridia | |

A left pyelogram (Fig 13) showed double kidney with double ureters terminating in the bladder strictures of double ureters and hydronephrosis.

On August 22 1929 under ether anaesthesia a suprapubic cystotomy was made. The stricture of the upper left ureter was cut and sounds up to No. 17 French were passed through the upper and lower ureteral orifices. Recovery uneventful.

Accessory ureter opening into the bladder

CASE 21 G B female aged 6 years was admitted to the Children's Memorial Hospital September 6 1928. Two years ago the patient had a sore throat with abdominal pain. Pus was found in the urine. This condition improved with medical treatment. Six months ago the child had an attack of pneumonia and again a large amount of pus was found in the urine. The condition again improved with internal treatment and the patient was well until a week ago when she developed a severe sore throat and pus was again found in the urine. In this present attack the ears were noted enlarged glands of the neck the temperature was 103 degree and there was frequency of urination. Physical examination disclosed a well developed and nourished child with enlarged cervical glands and a severe nasal discharge. There was slight tenderness over the left lumbar region. Urinalysis showed albumin ++ sugar 0.

blood ++ much pus many red blood cells. Blood examination showed red blood cells 4,330,000 leucocytes 16,850 haemoglobin 70 per cent. Blood chemistry analysis showed urea nitrogen 4 creatinine 1.6 non protein nitrogen 42. Roentgen ray examination was negative for stone. Cystoscopic examination showed the bladder and ureteral orifices to be normal. The ureters were catheterized. Examination of the urethra showed the opening of an accessory ureter just anterior to the internal sphincter. Pus was seen coming from this ureter. The catheter passed into this ureter for only a short distance. Culture showed streptococcus viridans. Pyelograms disclosed bilateral hydronephrosis. Operation advised and refused.

Accessory ureter opening at the internal urethral orifice

CASE 22 P D female aged 9 years was admitted to the Children's Memorial Hospital September 11 1930. Urinary dribbling had been present since birth. As a baby she never had a dry diaper. It was thought the child would do better when older and trained but these expectations were never realized. The bloomers were wet shortly after changing. She urinated frequently and the urine could not be held for long periods of time between urinations. The urine was constant dribbling. Condition had become more marked during the past 2 years. Physical examination was negative except that over the middle of the sacrum in midline dorsally there was a defect in the bone that admitted two fingers. External genitalia were negative except that just below the external urethral orifice was seen a small opening that discharged urine. A ureteral catheter was inserted into this opening and a prompt flow of urine was obtained. Cystoscopic examination was carried out while the catheter was in place. A normal bladder and two normally located ureteral orifices were found. The ureters were catheterized without difficulty or obstruction. Pyelograms were made (Fig 14).

Examination of urine obtained at this time showed the following:

| | Leucocytes per mm | Culture |
|------------------|-------------------|--------------------|
| Bladder | 195 | Bacillary pyelitis |
| Accessory ureter | 157 | |
| Left ureter | 57 | |
| Right ureter | 35 | |

Roentgen ray examination was negative for stone. Spina bifida occulta was present.

Blood examination showed red blood cells 4,060,000 leucocytes 10,950 haemoglobin 80 per cent. Urinalysis showed albumin ++ blood 0 sugar 0. Sediment showed pus and red blood cells. On October 1930 under ether anaesthesia a heminephrectomy was done with resection of the accessory ureter as far down as was convenient (Fig 15). The normal ureter as well as the accessory ureter was dilated and tortuous. Histological report

kidney resected showed the presence of chronic pyelitis and hydronephrotic atrophy
Result recovery uneventful

SPINA BIFIDA

In spina bifida cases certain urinary symptoms occur that bring these patients to consult the urologist at once and at other times the urinary symptoms are so pronounced that the advice of the urologist is sought. Although spina bifida is rare nevertheless these cases form an exceedingly interesting group from the standpoint of differential diagnosis. Because of the associated incontinence many cases are regarded as and treated for enuresis of course with complete failure. All cases of suspected enuresis therefore should be subjected to a careful and complete urological study as well as to a neurological examination to rule out organic disease as a factor in the production of the so called enuresis. This applies not only to spina bifida cases but to cases of renal tuberculosis with bladder symptoms and stone in the bladder.

The management of spina bifida cases is of course exceedingly difficult at present the tendency seems to be to subject these patients to a laminectomy.

Those interested in this problem are referred to the recent article on this subject by Mertz and Smith who report 13 cases and give a careful review of the literature on the subject.

ILLUSTRATIVE CASE OF SPINA BIFIDA

Spina bifida bilateral hydronephrotic pyelitis—left

CASE 23 G C female aged 2 years was admitted to the Presbyterian Hospital April 13 1928. She had had a lump on the back since birth. The lump seemed to grow at the same rate as she did generally. She had suffered from involuntary urination since birth until 4 weeks ago when complete retention developed. She was catheterized daily for 4 days. Involuntary urination again occurred until 5 days ago when complete retention developed. For the past 7 weeks the urine had been cloudy. She had had chills and fever with temperature varying from 99 to 105 degrees. Physical examination was negative except for a rather prominent abdomen with large abdominal veins. The bladder could be felt 2 inches above the pubis as a firm thick organ. Over the lumbar vertebrae was a large soft fluctuant area about 4 inches in diameter covered with skin which

protruded about 1½ inches. Neurological examination was negative. Blood examination showed red cells 4 120 000 leucocytes 16 200 hemoglobin 75 percent. Cystoscopic examination revealed a normal bladder. The ureters were catheterized without difficulty or obstruction. Urine obtained at that time showed

| | Le | ocyt | p | mm | Cultur |
|--------------|----|------|-----|----|----------------|
| Bladder | | | 150 | | Colon bacillus |
| Right kidney | | | 50 | | Colon bacillus |
| Left kidney | | | 0 | | Sterile |

Pyelograms were made and showed slight dilatation of kidney pelvis and calyces marked dilatation of ureters.

Result patient left the hospital without permission.

OBSTRUCTION TO THE OUTFLOW OF URINE

Lesions of the urinary tract which cause obstruction to the outflow of urine may be located anywhere along the urinary tract from the urethral orifice to the vesical neck and they produce what is called mechanical obstruction. There is another type of obstruction which is due to disease of the central nervous system and hence is neurologic in origin. Among the former type may be mentioned a very tight prepuce as well as a pin point meatus—lesions which are obvious and offer no diagnostic problem. Lesions of the urethra such as tumors (very rare) and urethral calculi may produce obstruction to the outflow of urine.

Obstruction at the vesical neck so called fibrosis of the vesical orifice was formerly looked upon as a very rare condition occurring only in the adult. When the urinary problems of infancy and childhood became more intensively studied however obstruction at the vesical neck became more and more frequently recognized so that today judging from recent writings these lesions are not really rare. All the cases I have seen have been in boys and while it seems to be the general belief that the lesion is peculiar to the male sex Beer and Hyman state that they have seen a similar picture in girls.

The symptoms very often are highly suggestive of a lesion at the internal urethral orifice. The parents or nursemaid state that the patient is obliged to strain a good deal sometimes before the act of urination is started. In one of my cases a little boy bad

great difficulty in starting the stream and after the stream was started great straining was necessary to complete the act. He resembled from this viewpoint the old prostatic.

Associated with the great straining is the ability to make only a very small stream. Here as in prostatic obstruction the amount of residual urine increases and there is a gradually increasing frequency of urination both by day and night. Sooner or later infection sets in and the urine becomes turbid. Systemic manifestations occur in the form of chills and fever followed by sweats. Unfortunately the true condition is not recognized and the patient continues to be treated for relapsing pyelitis. Unless the obstruction is relieved the infection increases and eventually renal function is impaired, weight and appetite are diminished and severe anemia develops.

In one group of cases the first symptom noted was the presence of a suprapubic tumor which was generally discovered by the mother or the nursemaid. Dribbling may be so marked that the patients are continually wet, that is they soil their clothing by day and wet the bed at night. They are often treated for enuresis of course without relief since the true condition is not recognized.

The diagnosis as a rule presents no difficulties. Difficulty on urination with dribbling and the presence of a suprapubic tumor are almost pathognomonic and the passage of a small soft catheter demonstrates the presence of residual urine. When the catheter is passed advantage should be taken of it to make a cystogram at the same time. The cystogram will show the presence of a very large bladder frequently with regurgitation of the bromide solution up the ureters thus demonstrating the presence of hydro ureters and hydronephroses. In the early cases the dilatation is only moderate while in some of the late cases it is extremely marked. It is in this group of cases that uroselectan will be of great value in demonstrating the associated hydro ureters and hydronephroses since the phenomenon of regurgitation does not always occur when the cystograms are made.

Although fibrosis is the common cause of obstruction at the vesical orifice other pathological conditions occasionally are the cause. In a case previously reported the obstruction was due to a prolapse of the ureter which covered the internal urethral orifice thus causing obstruction residual urine and enormous dilatation of the higher urinary tract.¹

The treatment must be directed toward relieving the obstruction. Preliminary bladder drainage and improvement of the renal function is necessary in some of the advanced cases. All the cases of this type of obstruction reported here have been treated by means of a suprapubic cystotomy with excision of a wedge shaped piece from the fibrous neck followed by a digital dilatation of the urethra. If valves are present in the posterior urethra they may be destroyed at the same time.

HYPERTROPHY OF THE VERUMONTANUM

Hypertrophy of the verumontanum may produce a very marked obstruction to the outflow of urine and cases have been reported in which the obstruction led to complete renal atrophy and death. Bugbee and Wollstein have studied cases of this type of obstruction and Robinson has published an excellent article on hypertrophy of the verumontanum as a factor in urinary obstruction with a detailed report of 1 case.

ILLUSTRATIVE CASE OF OBSTRUCTION

Cont. cture of the vesical neck with bilateral hydronephrosis

CASE 24. P. S. male aged 5 years was admitted to the Children's Memorial Hospital on the service of Dr. Aldrich September 13, 1927. The child was well until 10 months ago. Following an acute cold urination was painful and necessitated great straining. Because of pain the child held his urine as long as he could and voided only two or three times a day. He gained so much that the bowels met mes moved at the same time and these stools at times showed blood. He had no erections since he was 10 days old. He has a slight conjunctivitis with triangular opacity in left lower quadrant of the cornea. The heart, lung and abdominal were negative as were the cervical ganglia negative. Roentgen ray examination was negative. Urinalysis showed cloudy urine albumen + + + + sugar 0 protein + + + + few red blood cells. Cultures showed staphylococcus. Bilateral

chemistry analysis showed urea nitrogen 17, uric acid 25, creatinine 15, non protein 35. Residual urine was 345 cubic centimeters. At cystoscopic examination the cystoscope entered with a feeling of tightness. The internal urethral orifice was white and a small elevation was seen at the base of the bladder. The catheters met an obstruction on both sides and no urine was obtained from either kidney. Examination of the bladder specimen at this time showed 2500 leucocytes per cubic millimeter. Culture showed staphylococci.

Bilateral pyelograms (Fig. 16) were made and showed enormous dilatation of the ureters from the ureterovesical junction to the kidney pelvis and bilateral hydronephrosis. Operation was done November 1, 1927, and consisted in a suprapubic cystostomy for drainage with daily irrigations. A second operation was done July 17, 1928, when a wedge-shaped piece of tissue was removed from the internal urethral orifice and the posterior urethra was dilated with the fingers. The ureters were dilated with Van Buren sounds up to and including No. 16 French and No. 12 soft rubber urethral catheters were inserted into the ureters for drainage. Subsequent pyelograms showed a normal kidney pelvis and ureters on the left side and a very slight remaining dilatation on the opposite side.

Result: patient made an uneventful recovery and left the hospital much improved.

DIVERTICULUM OF THE BLADDER

Diverticulum of the bladder in children is generally associated with obstruction at the neck of the bladder. Although the condition is rare in children, the possibility of its presence must always be thought of in every case in which a diagnosis of fibrosis of the vesical neck has been made. Unless diverticula are recognized and removed, particularly if they are large, the result may be failure to relieve the patient of his symptoms to remove which a surgical operation has been done, just as failure to remove a diverticulum in the adult is the cause in many instances of prostaticomy failing to give relief. Diverticula may be very easily demonstrated by means of the cystogram. As a rule the opening of a diverticulum can be seen on examination with the cystoscope, yet it is well known, especially if the patient is examined during a sharp attack of cystitis, that the diverticulum may be overlooked.

As a rule the orifice of the diverticulum is small and presents no relationship to the size of the sac. The opening appears as a round hole, its edges are sharply defined, and the

mucous membrane may show some puckering. Diverticula vary in size from a small sac the size of a hazelnut to an extremely large sac that may be almost as large as the bladder itself.

Diverticula occur with predilection in the region of the ureteral orifices and the ureteral opening may be found in the sac. Great care must be exercised therefore in their removal lest the ureter be injured during the dissection.

Bladder diverticulum and contracture of bladder neck

CASE 25. R. C. male, aged 2½ years, referred by Dr. Krost, was admitted to the Presbyterian Hospital August 10, 1923. Dribbling of urine has been noted since birth. For the past 2 months the child has had chills, fever, vomiting and bladder distention. Physical examination by Dr. Krost was negative except for distention of the bladder. Roentgen ray examination was negative. Cystoscopic examination revealed marked trabeculation of the bladder and an opening of a diverticulum in the region of the right ureteral orifice. A cystogram showed a diverticulum on the right side of the bladder. Operation under ether anesthesia was done September 18, 1923, and consisted in resection of the diverticulum. The internal urethral orifice was hard, firm and contracted. Two incisions were made into the internal urethral orifice which resulted in relieving the contraction. Further dilatation of the internal urethral orifice was done with the finger.

Result: patient left the hospital October 17, 1923, completely relieved.

CONGENITAL VALVES OF THE POSTERIOR URETHRA

Congenital valves of the posterior urethra are relatively rarely found in children. If present they are seldom recognized until great damage has been done to the upper urinary tract because of mechanical obstruction. It is therefore exceedingly important that such a possibility be kept in mind in making a diagnosis in all cases of chronic urinary obstruction. Then if proper diagnostic procedures are instituted the condition should be recognized early instead of late, proper treatment can be instituted and much renal damage thus prevented.

The seeming relatively rare occurrence of congenital valves of the posterior urethra is probably due to the fact that few clinical cases have been reported and when these cases come to autopsy great renal destruction is found.

Congenital valves of the posterior urethra have been recognized for many years. Among

great difficulty in starting the stream and after the stream was started great straining was necessary to complete the act. He resembled from this viewpoint the old prostatic

Associated with the great straining is the ability to make only a very small stream. Here as in prostatic obstruction the amount of residual urine increases and there is a gradually increasing frequency of urination both by day and night. Sooner or later infection sets in and the urine becomes turbid. Systemic manifestations occur in the form of chills and fever followed by sweats. Unfortunately the true condition is not recognized and the patient continues to be treated for relapsing pyelitis. Unless the obstruction is relieved the infection increases and eventually renal function is impaired, weight and appetite are diminished and severe anemia develops.

In one group of cases the first symptom noted was the presence of a suprapubic tumor which was generally discovered by the mother or the nursemaid. Dribbling may be so marked that the patients are continually wet that is they soil their clothing by day and wet the bed at night. They are often treated for enuresis of course without relief since the true condition is not recognized.

The diagnosis as a rule presents no difficulties. Difficulty on urination with dribbling and the presence of a suprapubic tumor are almost pathognomonic and the passage of a small soft catheter demonstrates the presence of residual urine. When the catheter is passed advantage should be taken of it to make a cystogram at the same time. The cystogram will show the presence of a very large bladder frequently with regurgitation of the bromide solution up the ureters thus demonstrating the presence of hydro ureters and hydronephroses. In the early cases the dilatation is only moderate while in some of the late cases it is extremely marked. It is in this group of cases that uroselectan will be of great value in demonstrating the associated hydro ureters and hydronephroses since the phenomenon of regurgitation does not always occur when the cystograms are made.

Although fibrosis is the common cause of obstruction at the vesical orifice other pathological conditions occasionally are the cause. In a case previously reported the obstruction was due to a prolapse of the ureter which covered the internal urethral orifice thus causing obstruction, residual urine and enormous dilatation of the higher urinary tract.¹

The treatment must be directed toward relieving the obstruction. Preliminary bladder drainage and improvement of the renal function is necessary in some of the advanced cases. All the cases of this type of obstruction reported here have been treated by means of a suprapubic cystostomy with excision of a wedge shaped piece from the fibrous neck followed by a digital dilatation of the urethra. If valves are present in the posterior urethra they may be destroyed at the same time.

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Hypertrophy of the verumontanum may produce a very marked obstruction to the outflow of urine and cases have been reported in which the obstruction led to complete renal atrophy and death. Bugbee and Wollstein have studied cases of this type of obstruction and Robinson has published an excellent article on hypertrophy of the verumontanum as a factor in urinary obstruction with a detailed report of 1 case.

ILLUSTRATIVE CASE OF OBSTRUCTION

Cont. acts o of the vesical neck with bilateral ureteral strictures 1/3rd o ureters and 1/3rd nepl osis

CASE 24. P. S. male aged 5 years was admitted to the Children's Memorial Hospital on the service of Dr. Aldrich September 13, 1927. The child was well until 10 months ago. Following an acute cold urination was painful and he expressed great strain. Because of pain the child held his urine as long as he could and voided only two or three times a day. He strained so much that the bowels sometimes moved at the same time and these stools at times showed blood. He has had sore eyes since he was 10 days old. He has a slight conjunctivitis with triangular opacity in left lower quadrant of the cornea. The heart, lungs and abdomen were negative as were the external genitalia negative. Roentgen ray examination was negative. Urinalysis showed cloudy urine, albumin + + +, sugar 0, pus + + + +, few dried blood cells. Cultures showed staphylococcus. Blood

LESIONS OF THE CENTRAL NERVOUS SYSTEM

In the adult certain lesions of the central nervous system produce both urinary and sexual symptoms in fact urinary symptoms are present in almost all adults so afflicted. *Tabs dorsalis* is the most frequent lesion found but it is by no means the only lesion of the central nervous system. Much interest is again manifested in this subject of so called spinal cord bladder. Although this condition has seldom been reported in children doubtless due to the fact that spinal cord bladder is not a common disease of childhood nevertheless its possibility should not be overlooked especially when the urinary symptoms are prominent for the underlying cause may be some disease process of the central nervous system. It should be the duty of the urologist to bear this fact in mind when he makes his examination. It is our practice always to have a complete and careful neurological examination in all doubtful cases in order to exclude a lesion of the central nervous system.

Spinal cord bladder due to polymyelitis

CASE 27 A Z female aged 5½ years was admitted to the Children's Memorial Hospital on the service of Dr Berkheiser May 24 1927. Patient had had infantile paralysis at the age of 3 years. Both feet had been operated upon for talipes equinovarus 1 year ago. Patient had suffered from incontinence of urine practically all her life and had never developed control of the bladder. Physical examination revealed a poorly nourished child who walked unsteadily with a tendency to the talipes position of the feet. In the lower abdomen to the midline was a large swelling dull to percussion. Knee jerks were absent. Examination of the urine showed albumin ++ sugar 0 pus +++ casts 0. Blood chemistry analysis showed urea nitrogen 18 uric acid 4.4 creatinine 1.6 non protein nitrogen 44. The Wassermann test gave a negative reaction. A cystogram was negative. Cystoscopic examination revealed hypertrophy of the interureteric ligament and some trabeculation. To the right of the right ureteral orifice there was seen a small superficial diverticulum. Examination of urine obtained at that time showed

| | Leocytes | Cultures |
|--------------|----------|----------------------|
| | per mm | |
| Bladder | 164 | Colon bacillus |
| Right kidney | 610 | Staphylococcus albus |

A pyelogram of right side showed a dilated pelvis. Neurological examination was made by Dr Hamill. He thought the condition was due to an old poly-

myelitis. The spinal fluid Wassermann test gave a negative reaction.

Treatment consisted in the use of an indwelling catheter.

Result patient left the hospital unimproved.

Malignant tumor of spinal cord with complete retention of urine

CASE 28 E J male aged 8 years was admitted to the Children's Memorial Hospital on the service of Dr A H Montgomery July 2 1930. Three weeks ago the child fell down stairs (two floors) and injured his back. He got up and walked upstairs and for 3 days he had difficulty in getting about. Since then he has been confined to bed and unable to walk. Physical examination revealed an acutely ill child unable to move the lower extremities. The bladder was distended above the umbilicus. The scrotum was edematous. Pressure over the lower thoracic region caused pain. An ulcer was noted at the external urethral orifice. There was complete loss of sensation below the costal margin. Tentative diagnosis of traumatic spine with spinal cord bladder was made. Urinalysis showed albumin +++ sugar 0 pus + casts many. Because of the distention and inability to void indwelling urethral catheter drainage was advised.

Roentgen ray examination (3 cubic centimeters of lipiodol was injected into the lumbar spine) showed a blocking of the fluid at the level of the third lumbar. Subsequent study by Drs Hamill Brennemann and Loyal Davis resulted in a diagnosis of spinal cord tumor which was verified by laminectomy.

On August 8 1928 under ether anesthesia operation was done by Dr Loyal Davis who removed the spinal cord tumor. Histological examination showed round cell sarcoma.

Result child continued to fail and died November 27 1928. Autopsy was not obtained.

Glioma of optic chiasm

CASE 29 E M female aged 12 years was admitted to the Presbyterian Hospital on the service of Dr C Grulee June 14 1927. Patient had had enuresis since birth. Two years ago she was hit in the head by a bus. Roentgen ray examination at that time was negative for fracture. Since the accident she has had headaches associated with pain in the eyes and vomiting which comes on only in the morning after eating breakfast. She has worn glasses for 2 years but there has been no disturbance of vision.

Physical examination was negative except for the fundus findings (Dr Allen). The left eye showed a pseudo papillitis there was right incomplete hemianopsia in left the entire upper quadrant was involved. The Wassermann test was negative.

Roentgen ray examination of the head showed no bone change. The sella was within normal limits. Treatment consisted in the administration of salvarsan and two courses of mercury rubs followed by potassium iodide.

the earliest cases in the literature are the following

Budd in 1840 reported a case in a sailor aged sixteen who died several days after admission to the hospital in a state of coma. Godart in 1854 compared the valves in his case to a pigeon's nest or the sigmoid valves. Picard in 1855 described a case of true valves complicated with convulsions. Autopsies were performed in all of these cases hence the diagnoses were not mere speculation as they are in many instances.

In 1870 Tolmatschew wrote the first discussion on congenital valves of the posterior urethra as a definite clinical entity and brought the literature up to date. He included the cases of Budd, Bednar, Godart and Guyon.

Young, Frontz and Baldwin in 1919 reported 23 cases which were found in the literature and added reports of 12 cases of their own.

In 1924 Hinman and Kutzman added 6 personal cases together with 15 cases from the literature making a total of 56. A thorough search of the literature since Hinman's summary in 1915 revealed 8 additional cases. Recently Randall reported 2 cases which made a total of 66 cases. In 1929 Pierson and I had the good fortune to report 3 new cases which brought the total up to 69 cases. Two of these 3 cases were proved by autopsy. One case was operated upon and complete relief was obtained. Since our paper was published Randall has reported a third case making a total of 70 cases reported to date.

TYPES OF CONGENITAL VALVES OF POSTERIOR URETHRA

In reviewing the literature Tolmatschew found references to several classifications for instance Jarjavay describes circular and semilunar valves and Bouillard mentions the possibility of twofold and threefold valves. Tolmatschew stated that the known valves have been divided into four classes namely (1) those posterior to the fossa navicularis (2) those posterior to the bulbous urethra (3) those anterior to the verumontanum and (4) at the anterior margin of the field in front of (3).

Modern writers classify their cases according to the system of Young, Frontz and Baldwin which consists of three types: (1) one of two semilunar folds running anteriorly from the verumontanum toward the penile urethra (2) semilunar folds running posteriorly from the upper edge of the verumontanum (they describe only one case of this type in which a valve consisted of a fold) (3) the iris valve bearing no relation to the verumontanum and attached to the entire circumference of the urethra with a small opening near the center.

The treatment of congenital valves may be surgical or non surgical. A suprapubic cystostomy may be made to destroy the valves. Frontz has advised the non surgical treatment by means of an especially small constructed Young punch.

ILLUSTRATIVE CASE OF CONGENITAL VALVES

Congenital valves of the posterior urethra

CASE 26. C. E. male aged 5 years referred by Dr. William Hibbs was admitted to the Presbyterian Hospital November 12, 1928. Since birth patient had had difficulty in passing urine, the stream being small and the act was associated with urgency and frequency. Frequency was more pronounced during the forenoon, the intervals ranging from 10 to 20 minutes. During the remainder of the day the child urinated from three to four times. Physical examination was negative except for the presence of a suprapubic tumor about the size of a large grapefruit. Examination of urine disclosed 50 pus cells per cubic millimeter. Blood chemistry analysis showed urea nitrogen 17.8, uric acid .7, creatinine 1.1, non-protein nitrogen 41.7. The Wassermann test gave a negative reaction. A small cystoscope entered the bladder without difficulty or obstruction. Examination gave completely negative results. No evidence of disease around the internal urethral orifice but it was impossible to pass a No. 16 curved sound through the prostatic urethra. Roentgen ray examination of the spine showed no evidence of spina bifida occulta. A cystogram revealed a normal bladder relatively large for the size and age of the patient. A urethrogram showed dilatation beyond the junction of the prostatic and membranous urethra. In front of this apparent obstruction the urethra measured 5 millimeters and behind it 8 millimeters. A preoperative diagnosis of congenital valves of the posterior urethra was made. Operation was done under ethylene and ether anesthesia on November 21, 1929. Through a suprapubic cystostomy the valves were destroyed.

Recovery was uneventful and the patient left the hospital on December 23, 1928.

LESIONS OF THE CENTRAL NERVOUS SYSTEM

In the adult certain lesions of the central nervous system produce both urinary and sexual symptoms in fact urinary symptoms are present in almost all adults so afflicted. *Tabes dorsalis* is the most frequent lesion found but it is by no means the only lesion of the central nervous system. Much interest is again manifested in this subject of so called spinal cord bladder. Although this condition has seldom been reported in children doubtless due to the fact that spinal cord bladder is not a common disease of childhood nevertheless its possibility should not be overlooked especially when the urinary symptoms are prominent for the underlying cause may be some disease process of the central nervous system. It should be the duty of the urologist to bear this fact in mind when he makes his examination. It is our practice always to have a complete and careful neurological examination in all doubtful cases in order to exclude a lesion of the central nervous system.

Spinal cord bladder due to poliomyelitis

CASE 27. A. Z. female aged 5½ years was admitted to the Children's Memorial Hospital on the service of Dr. Berkheiser May 24 1927. Patient had had infantile paralysis at the age of 3 years. Both feet had been operated upon for talipes equinovarus 1 year ago. Patient had suffered from incontinence of urine practically all her life and had never developed control of the bladder. Physical examination revealed a poorly nourished child who walked unsteadily with a tendency to the talipes position of the feet. In the lower abdomen in the midline was a large swelling dull to percussion. Knee jerks were absent. Examination of the urine showed albumin ++ sugar o pus +++ casts o. Blood chemistry analysis showed urea nitrogen 18, uric acid 4.4, creatinine 6, non protein nitrogen 44. The Wassermann test gave a negative reaction. A cystogram was negative. Cystoscopic examination revealed hypertrophy of the interureteric ligament and some trabeculation. To the right of the right ureteral orifice there was seen a small superficial diverticulum. Examination of urine obtained at that time showed

| | | | |
|--------------|-----|-------|----------------------|
| | Le | cytes | Cultur |
| Bladder | P | man | |
| | 164 | | Colon bacillus |
| Right kidney | 610 | | Staphylococcus albus |

A pyelogram of right side showed a dilated pelvis. Neurological examination was made by Dr. Hamill. He thought the condition was due to an old poly-

myelitis. The spinal fluid Wassermann test gave a negative reaction.

Treatment consisted in the use of an indwelling catheter.

Result: patient left the hospital unimproved.

Malignant tumor of spinal cord with complete retention of urine

CASE 28. E. J. male aged 8 years was admitted to the Children's Memorial Hospital on the service of Dr. A. H. Montgomery July 2 1930. Three weeks ago the child fell down stairs (two floors) and injured his back. He got up and walked upstairs and for 3 days he had difficulty in getting about. Since then he has been confined to bed and unable to walk. Physical examination revealed an acutely ill child unable to move the lower extremities. The bladder was distended above the umbilicus. The scrotum was oedematous. Pressure over the lower thoracic region caused pain. An ulcer was noted at the external urethral orifice. There was complete loss of sensation below the costal margin. Tentative diagnosis of traumatic spine with spinal cord bladder was made. Urinalysis showed albumin +++ sugar o pus + casts many. Because of the distention and inability to void indwelling urethral catheter drainage was advised.

Roentgen ray examination (3 cubic centimeters of lipiodol was injected into the lumbar spine) showed a blocking of the fluid at the level of the third lumbar. Subsequent study by Drs. Hamill, Brennemann, and Loyal Davis resulted in a diagnosis of spinal cord tumor which was verified by laminectomy.

On August 8 1928 under ether anesthesia operation was done by Dr. Loyal Davis who removed the spinal cord tumor. Histological examination showed round cell sarcoma.

Result: child continued to fail and died November 7 1928. Autopsy was not obtained.

Glioma of optic chiasm

CASE 29. E. M. female aged 11 years was admitted to the Presbyterian Hospital on the service of Dr. C. Grulee June 14 1927. Patient had had enuresis since birth. Two years ago she was hit in the head by a bus. Roentgen ray examination at that time was negative for fracture. Since the accident she has had headaches associated with pain in the eyes and vomiting which comes on only in the morning after eating breakfast. She has worn glasses for 2 years but there has been no disturbance of vision.

Physical examination was negative except for the fundus findings (Dr. Allen). The left eye showed a pseudo papillitis; there was right incomplete hemianopsia in left the entire upper quadrant was involved. The Wassermann test was negative.

Roentgen ray examination of the head showed no bone change. The sella was within normal limits. Treatment consisted in the administration of salvarsan and two courses of mercury rubs followed by potassium iodide.

the earliest cases in the literature are the following

Budd in 1840 reported a case in a sailor aged sixteen who died several days after admission to the hospital in a state of coma. Godart in 1854 compared the valves in his case to a pigeon's nest or the sigmoid valves. Picard in 1855 described a case of true valves complicated with convulsions. Autopsies were performed in all of these cases hence the diagnoses were not mere speculation as they are in many instances.

In 1870 Tolmatschew wrote the first discussion on congenital valves of the posterior urethra as a definite clinical entity and brought the literature up to date. He included the cases of Budd, Bednar, Godart and Guyon.

Young, Frantz and Baldwin in 1919 reported 23 cases which were found in the literature and added reports of 12 cases of their own.

In 1924 Hinman and Kutzman added 6 personal cases together with 15 cases from the literature making a total of 56. A thorough search of the literature since Hinman's summary in 1925 revealed 8 additional cases. Recently Randall reported 2 cases which made a total of 66 cases. In 1929 Pierson and I had the good fortune to report 3 new cases which brought the total up to 69 cases. Two of these 3 cases were proved by autopsy. One case was operated upon and complete relief was obtained. Since our paper was published Randall has reported a third case making a total of 70 cases reported to date.

TYPES OF CONGENITAL VALVES OF POSTERIOR URETHRA

In reviewing the literature Tolmatschew found references to several classifications for instance Jarjavay describes circular and semilunar valves and Bouillard mentions the possibility of twofold and threefold valves. Tolmatschew stated that the known valves have been divided into four classes namely (1) those posterior to the fossa navicularis (2) those posterior to the bulbous urethra (3) those anterior to the verumontanum and (4) at the anterior margin of the field in front of (3).

Modern writers classify their cases according to the system of Young, Frantz and Baldwin which consists of three types: (1) one of two semilunar folds running anteriorly from the verumontanum toward the penile urethra (2) semilunar folds running posteriorly from the upper edge of the verumontanum (they describe only one case of this type in which a valve consisted of a fold) (3) the iris valve bearing no relation to the verumontanum and attached to the entire circumference of the urethra with a small opening near the center.

The treatment of congenital valves may be surgical or non surgical. A suprapubic cystostomy may be made to destroy the valves. Frantz has advised the non surgical treatment by means of an especially small constructed Young punch.

ILLUSTRATIVE CASE OF CONGENITAL VALVES

Congenital valves of the posterior urethra

CASE 6 C E male aged 5 years referred by Dr William Hibbs was admitted to the Presbyterian Hospital November 12 1928. Since birth patient had had difficulty in passing urine the stream being small and the act was associated with urgency and frequency. Frequency was more pronounced during the forenoon the intervals ranging from 10 to 20 minutes. During the remainder of the day the child urinated from three to four times. Physical examination was negative except for the presence of a suprapubic tumor about the size of a large grapefruit. Examination of urine disclosed 50 pus cells per cubic millimeter. Blood chemistry analysis showed urea nitrogen 17.8 uric acid 2.7 creatinine 1.1 iron protein nitrogen 41.7. The Wassermann test gave a negative reaction. A small cystoscope entered the bladder without difficulty or obstruction. Examination gave completely negative results. No evidence of disease around the internal urethral orifice but it was impossible to pass a No. 16 curved sound through the prostatic urethra. Roentgen ray examination of the spine showed no evidence of spinal bifida occulta. A cystogram revealed a normal bladder relatively large for the size and age of the patient. A urethrogram showed dilatation beyond the junction of the prostatic and membranous urethra. In front of this apparent obstruction the urethra measured 5 millimeters and behind it 8 millimeters. A preoperative diagnosis of congenital valves of the posterior urethra was made. Operation was done under ethylene and ether anesthesia on November 21 1929. Through a suprapubic cystostomy the valves were destroyed.

Result: recovery was uneventful and the patient left the hospital on December 3 1928.

ARTERIAL ENCEPHALOGRAPHY AND ITS VALUE IN THE
DIAGNOSIS OF BRAIN TUMORSEGAS MONIZ LISBON PORTUGAL
Professor of Neurology and PsychiatryMANDIO PINTO LISBON PORTUGAL
Surgical AssistantALMEIDA LIMA LISBON PORTUGAL
Assistant

THE first study of arterial encephalography dates back to 1927. In that year Moniz read a paper on the subject before the Society for Neurology and Academy of Medicine in Paris (1).

Since then we have been quite uniformly successful in localizing brain tumors by the method which consists briefly in injecting into the internal carotids an opaque liquid which renders impervious to the X-ray the whole system of brain arteries. The alterations in the arterial system produced by the tumors are a means of locating the latter. An encephalographic study is easily made and the method may be used in any patient suspected of having a brain tumor. As to contra-indication it should not be used in the presence of sclerosis of the brain arteries and it should not be repeated in the same case.

In addition to the instruments commonly used in a minor surgical operation we need only two special forceps—a 10 cubic centimeter syringe and a platinum needle. The forceps which are a kind of ring pincers of the Antonio Martins type (Fig. 1) slightly modified by one of us are used for the temporary obliteration of the arteries. The platinum needle is 8 centimeters by 1 millimeter and is made in the form of a bayonet.

The opaque liquid used is a chemically pure recently prepared watery (2 to 5 per cent) solution of iodide of sodium. As this solution is quickly diluted by the blood and thus ceases to possess the indispensable quality of opacity under the X-rays it is necessary to photograph the head immediately after the injection and to use a sufficiently quick apparatus.

PREPARATORY TREATMENT OF PATIENT

It is advisable to give the patient 30 centigrams of luminal both the night before and

early on the day of examination. We have thus frequently avoided an accident which although not at all serious may at times be troublesome because of its severity. We refer to epileptic attacks which may follow the injection. Such attacks in our experience have usually been homolateral and have been of the Jackson type.

LAYING OPEN THE CAROTID

As it is impossible to make the injection direct it is necessary first to expose the carotids. At first we attempted to make the injection direct into the internal carotid but at times this was found difficult especially when the bifurcation of the common carotid was located farther up than usual. To avoid this difficulty we made the injection into the common carotid temporarily obliterating the external carotid. In our opinion we must be eclectic we shall follow the first practice always when practicable which would be true in most cases and shall reserve the second procedure for the cases in which the bifurcation of the carotid is far above the normal position. The second procedure is a very much easier one. However in some cases it means that the incision must be made low and at times lengthened. For these reasons it is not recommended for all cases especially from an æsthetic point of view which we must always take into account since the procedure is but a means of diagnosis.

We always use local anesthesia but this does not mean that general anesthesia should not be used in patients with precarious mental conditions. The operation can be carried out very well under a simple superficial anesthesia for it has been established and the premises can be easily verified that the deeper parts of the neck are practically insensible.

Patient re entered the hospital November 16 1927 The complaint at this time was continued enuresis although the other symptoms had disappeared Roentgen ray examination of the head showed no change

Urinalysis showed albumin 0 sugar 0 casts 0 blood 0 pus +

Examination (H L K.) showed no abnormality of the external urethral orifice and no leakage of urine Cystoscopic examination revealed a generalized trabeculation ureteral orifices normal Both ureters were catheterized and the urine obtained showed the following

| | Leucocytes p mm | Culture | Tube b illus |
|--------------|--------------------|---------|-----------------|
| Bl dd | 0 | Sterile | 0 |
| Right kid ey | 400 | Sterile | |
| Left kid y | 120 | Sterile | |

The pyelograms were normal Wassermann tests of spinal fluid gave negative reaction Nonne + cells 0

Neurologic examination by Dr P Bassoe was negative Treatment with mercury and potassium iodide was continued

On March 17 1928 the patient was admitted to the hospital for the third time She complained of vomiting and severe headaches Pain was most marked at the top of the head She has wet the bed every night Examination of the eyes by Dr Allen showed the same findings as before Roentgen ray examination of the head revealed a definite increase in the size of the sella Neurologic examination by Dr P Bassoe was negative except for a positive Babinski on the right side and a tendency to positive Oppenheim on both sides Patient was transferred to Billings Memorial Hospital

Operation was performed by Dr P Bailey on January 11 1929 A frontal exploratory operation revealed a glioma of optic chiasm

SUMMARY

1 Lesions of the urinary tract in infancy and childhood occur with greater frequency than is generally supposed

2 The types of lesions occurring in infancy and childhood closely parallel the types found in the adult with the exception of benign hypertrophy of the prostate and malignant disease of the prostate and bladder

3 In certain instances examination has revealed the presence of serious destructive lesions of the kidney lesions that might have

been cured had an early diagnosis been made and treatment instituted

4 The problems of diagnosis and treatment differ in no way from the same problems in the adult

5 Close co-operation between the general practitioner the pediatrician and the urologist is desired so that these patients may be examined in the early stages of their disorder and thus reap the benefit of proper treatment thereby preventing destruction of vital organs

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CASE 1 Large meningioblastoma at the base of the left temporal lobe. Maria, 36 years of age, felt quite well until 1927. In January of that year she became ill, having fever, delirium, headache, vomiting, and extreme drowsiness. In March she was obliged to stay in bed and had the same symptoms. In August she had another attack of headache, vomiting, and diplopia.

As time went on the patient felt better until January, 1928. Then she noticed rather pronounced involuntary movements in the right arm and later in the right leg. These movements did not diminish. She came to us for treatment in October, 1928; he cause she was losing her sight.

Examination showed facial asymmetry. Patient had a Parkinsonian facies which used to disappear on movement. The members of the right side were affected by pronounced oscillatory trembling which became stronger when moved voluntarily.

The examination of the olfactory nerve showed complete anosmia on the left side, difficulty of identification on the right side. There was a tumid neurtitis of both eyes. The vision of the right eye was $\frac{1}{2}$ of the left eye. Right temporal hemianopsia homonymous was also present.

Cerebrospinal fluid was under increased tension. A lateral radiogram disclosed some opaque points over the sella turcica as well as destruction of the posterior apophysis. Our diagnosis was central tumor of this region. Nevertheless we decided to prove our diagnosis by a cranial roentgenogram.

This we did and were fortunate in not having to deal with an epileptic crisis. The roentgenogram of the right side was normal (Fig. 2). It showed that the irrigation of the brain, both as proceeding from the sylvian group and the artery which one very rarely sees on account of the front communicating artery. On this arteriogram (Fig. 2) we are able to follow the anterior cerebral artery, C 1, the pericallosal artery, P C, the callosal marginal artery, C M, as well as the arteries which proceed therefrom. The arteriogram of the left side showed a dislocation of the sylvian group upward in a nearly perpendicular direction (Fig. 3) so that compared with Figure 2 the sylvian group appears to be placed 2.5 centimeters higher up. Diagnosis: tumor of the foremost part of the temporal lobe. The arteriogram discloses also other quite interesting features. We see a rather small stain in the posterior part of the ascending portion of the sylvian

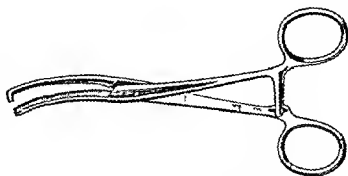


Fig. 1. Martin's forceps modified by Amandio Pinto.

group which is clearly dislocated. On examining the film carefully we also detect small arteries proceeding from the internal carotid moving upward toward the said stain. We also see another and smaller stain, not so distinct as the aforementioned one in the foremost part of the sylvian group. These stains are due to the impregnation by the sodium iodide of a special tissue which does not render easy a quick backward circulation. Therefore we decided that the growth was a rather vascularized tumor of this region, the larger part of which was located in the temporal lobe and the smaller part in the frontal lobe. Our diagnosis was meningioblastoma at the base of the left temporal region (large wing of the sphenoid bone) extending down to the posterior lower part of the frontal lobe compressing the peduncle and the central nuclei and at the base of the cranium where it was probably clinging reaching to the back clinoid process. Therefore it was probably a rather vascularized meningioma.

Operation was carried out on December 28, 1928. Local anesthesia was used. A large portion of the respective temporal region was cut open and the base of the tumor was explored. Little by little the lower part of the temporal lobe was made accessible. A finger inserted into the opening revealed the fact that all of the left half of the middle part of the cranium was filled by a hard tumor, very adherent at the base and quite independent of the brain. Very carefully we isolated the tumor and as best we could removed it. The most of it could be removed (Fig. 4) but removal caused a severe hemorrhage. We were able to check this by introducing tampons of wadding saturated in hot serum. This part of the operation was a rather long piece of work. The patient fell into a state of rather profound shock. Intravenous injections of serum were given. The pulse improved. After hemostasis was established we attempted an osteoplasty but because the brain showed a tendency to herniate we took the bone out. After the operation the general state of the patient improved a little, but during the night the pulse fell and death ensued from heart failure.

The postmortem examination revealed some blood clots in the left temporal lobe where the tumor had clung. We found destructive lesions which were

The patient is placed in the classic position required for ligature of the carotid. We then proceed to make the skin incision which will lead directly to the bifurcation of the carotid and does not leave too conspicuous a scar.

The incision begins at the external border of the sternocleidomastoid muscle on a level with the mandibular angle and follows the course of the muscle down to the fold that separates the submaxillary region from the respective part of the neck. The incision is slightly concave toward the upper end and is 2 to 3 inches in length depending on the development of the adipose tissue in the region. The cellular membrane of the muscle is opened and drawn backward the inner part being cut through longitudinally. We try to locate the artery by its pulsations. There are three possible ways of isolating the artery through the common carotid through its bifurcation or finally through a spot above the bifurcation. In the first instance which by the way is very rare we follow the upward course of the artery and attempt to isolate the internal carotid. If this is very difficult we isolate the external carotid so that we may obliterate it at the proper moment and we make the injection into the common carotid as already explained. In the other instances we isolate the internal carotid so that we may make the injection into it. We cannot identify the internal carotid solely by its position.

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If the internal carotid is easily accessible after a small segment in the first portion is isolated the special forceps is placed at once above its origin to bring about temporary hæmostasis without compressing the artery. If we decide to inject into the common carotid we affect hæmostasis by placing these forceps on the artery a little below the bifurcation

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TECHNIQUE OF THE INJECTION

The patient is placed in the required position under an X ray bulb that is he lies on the side opposite that to be injected with the head supported in such a way that the frame of the apparatus on which he lies remains in a horizontal position. The apparatus will be horizontal if the line of the patient's eyes is vertical. The head is held fixed in position and movement is prevented by means of a bandage. As soon as the attendant gives the signal that the apparatus is ready to use the artery is punctured by means of the needle. This procedure does not cause the patient any pain. It has been our custom when making the puncture in the common carotid to introduce the needle far enough to enter the internal carotid. In this way the injection is made just as though it had been started directly in the latter. Thus we avoid the reflex already mentioned—reflex the result of irritation of the reflexogenic cardiorespiratory zone of the carotid sinus. Once the artery is entered which we know has been done when blood enters the needle we press the hæmostatic forceps (one or two depending on whether the internal or the common carotid has been entered) and proceed with the injection. The quantity injected perhaps does not affect the result materially. We have obtained excellent radiograms with 4 or 5 cubic centimeters. At present we prefer to inject 6 or 7 cubic centimeters—a little less in the case of women—and we use 2 to 3 cubic centimeters for children. It is essential that the injection be made very quickly and that the radiogram be made at the very moment at which the quantity injected seems to be sufficient. To arrive at this result it cannot be the surgeon but an assistant who gives the photographer the necessary signal at the right moment. Once the film is developed and found satisfactory the operative incision is dealt with in the usual manner. If the photograph does not reveal the arteries sufficiently the injection is repeated.

We have made approximately 200 encephalograms in 100 patients with this method and

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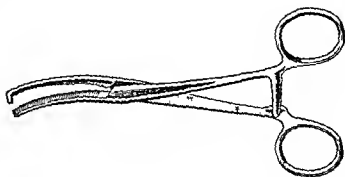


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We have made approximately 200 encephalograms in 100 patients with this method and

we may say that except in the presence of arteriosclerosis and in instances in which we used an iodide solution not sufficiently pure we have experienced no difficulties. We have thus succeeded in localizing brain tumors either by rendering visible the accessory circulation of the tumors or the dislocation of the arteries. We present brief histories of a few of our cases.

CASE 1 Large meningioblastoma at the base of the left temporal lobe. Maria, 36 years of age, felt quite well until 1927. In January of that year she became ill, having fever, delirium, headache, vomiting, and extreme drowsiness. In March she was obliged to stay in bed and had the same symptoms. In August she had another attack of headache, vomiting, and diplopia.

As time went on the patient felt better until January 1928. Then she noticed rather pronounced involuntary movements in the right arm and later in the right leg. These movements did not diminish. She came to us for treatment in October 1928; he cause she was losing her sight.

Examination showed facial asymmetry. Patient had a Parkinsonian facies which used to disappear on movement. The members of the right side were affected by pronounced oscillatory trembling which became stronger when moved voluntarily.

The examination of the olfactory nerve showed complete anosmia on the left side, difficulty of identification on the right side. There was a tumid nictus of both eyes. The vision of the right eye was $\frac{1}{3}$ of the left eye. Right temporal hemianopsia homonymous was also present.

Cerebrospinal fluid was under increased tension. A lateral radiogram disclosed some opaque points over the sella turcica as well as destruction of the posterior apophysis. Our diagnosis was central tumor of this region. Nevertheless we decided to prove our diagnosis by a cranial roentgenogram.

This we did and were fortunate in not having to deal with an epileptic crisis. The roentgenogram of the right side was normal (Fig. 2). It showed that the irrigation of the brain both as proceeding from the sylvian group and the artery which one very rarely sees on account of the front communicating artery. On this arteriogram (Fig. 2) we are able to follow the anterior cerebral artery *C A*, the pericallosal artery *P C*, the callosal marginalis artery *C M*, as well as the arteries which proceed therefrom. The arteriogram of the left side showed a dislocation of the sylvian group upward in a nearly perpendicular direction (Fig. 3) so that compared with Figure 2 the sylvian group appears to be placed 2.5 centimeters higher up. Diagnosis: tumor of the foremost part of the temporal lobe. The arteriogram discloses also other quite interesting features. We see a rather small stain in the posterior part of the ascending portion of the sylvian

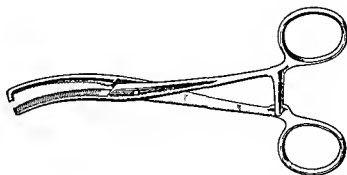


Fig. 1. Martins forceps modified by Amandio Pinto

group which is clearly dislocated. On examining the film carefully we also detect small arteries proceeding from the internal carotid moving upward toward the said stain. We also see another and smaller stain not so distinct as the aforementioned one in the foremost part of the sylvian group. These stains are due to the impregnation by the sodium iodide of a special tissue which does not render easy a quick backward circulation. Therefore we decided that the growth was a rather vascularized tumor of this region, the larger part of which was located in the temporal lobe and the smaller part in the frontal lobe. Our diagnosis was meningioblastoma at the base of the left temporal region (large wing of the sphenoid bone) extending down to the posterior lower part of the frontal lobe compressing the peduncle and the central nuclei and at the base of the cranium where it was probably clinging, reaching to the back clinoid process. Therefore it was probably a rather vascularized meningioma.

Operation was carried out on December 28, 1928. Local anesthesia was used. A large portion of the respective temporal region was cut open and the base of the tumor was explored. Little by little the lower part of the temporal lobe was made accessible. A finger inserted into the opening revealed the fact that all of the left half of the middle part of the cranium was filled by a hard tumor very adherent at the base and quite independent of the brain. Very carefully we isolated the tumor and as best we could removed it. The most of it could be removed (Fig. 4) but removal caused a severe hemorrhage. We were able to check this by introducing tampons of wadding saturated in hot serum. This part of the operation was a rather long piece of work. The patient fell into a state of rather profound shock. Intravenous injections of serum were given. The pulse improved. After hemostasis was established we attempted an osteoplasty but because the brain showed a tendency to herniate we took the bone out. After the operation the general state of the patient improved a little but during the night the pulse fell and death ensued from heart failure.

The postmortem examination revealed some blood clots. In the left temporal lobe where the tumor had clung we found destructive lesions which were

spreading into the posterior part of the frontal lobe. The quadrilateral bone at the base of skull was almost worn out. The anterior clinoid processes were very much reduced. The main wing of the left sphenoid bone and the left portion of the sella turcica were covered with a small amount of neoplastic tissue which it had been impossible to extract. The tumor did not go beyond the midline. Microscopic examination revealed that it was a case of meningioblastoma of fusiform cells fascicularly disposed — Ch. Oberling.

The autopsy showed that our diagnosis was entirely correct.

The symptomatology in this case was such as to make us believe we were dealing with an epidemic encephalitis. Patient had a lateral trembling of the intention type, a Parkinsonian facies and crises of drowsiness which symptoms were all in favor of the said diagnosis. It was the papillary stasis which cleared up the case. All of these symptoms however induced us to accept the hypothesis of a tumor of the infundibulohypophyseal region. The lateral radiogram of the head revealed two or three small calcifications in a very limited zone of the suprasellar region. The patient had a right sided temporal homonymous hemianopsia. But we did not believe that the growth involved the left temporal region because the hemianopsia was a complete one. Partial hemianopsia more characteristic of such localizations did not exist (Cushing). When resting the patient had a right facial paresis of the central type. Tumors of the first third of the temporal lobe as well as tumors of the frontal lobe can produce this same facial paralysis. Clovis Vincent mentioned this fact in his report to the Reunion Neurologique in 1928.

It is necessary to point out that this was a case of a very great compression and of destruction of a part of the left temporal lobe and yet there were missing sensory aphasia, paresis of the third cranial nerves (Puusepp), lateral buzzing or ringing, etc. The roentgenograms of the brain solved the problem. We learned from them that a large tumor had invaded the left temporal lobe as well as a part of the posterior region of the frontal lobe. The cranial nerves did not offer great difficulties in the present case. The olfactory and the optic nerves were compromised. The third

and fourth cranial nerves were normal but on the left side were in contact with the neoplastic tissue. The sixth a little farther away was normal but everyone knows that this nerve becomes sensible in cases of cranial hypertension. Close observation of the patient disclosed a passing diplopia. As to the remaining nerves only the facial was affected on the right side.

CASE 2. Tumor of the right temporal lobe. A J. 55 years of age railway engineer in July 1928 had an epileptic attack when driving an engine. Some weeks afterward he suffered another attack with clonic convulsions particularly strong on the left side of the body. At that time he noticed also a passing deafness in the right ear. In September and October he had headaches without localization. He did not vomit but was dizzy. His lower limbs were weak. Diplopia was noticed in January 1929. At the same time he noticed impairment of vision. When he came to see us he was amaurotic. An examination of the eyes made at that time showed tumid papillitis with exudation more pronounced on the left side. No reflexes. Abdominal and cremasteric reflexes were abolished. Sensations were normal. There was loss of sight first on the left and then on the right side — exudative papillary stasis. Slight facial paresis was noticed on the right side. Hearing was rather reduced on the right side. Rinne test was positive. All other nerves were normal.

Patient was euphoric, had no just appreciation of his condition and he continually talked of episodes of his life as an engineer.

Localization on the basis of the neurologic findings was not possible. The patient did not present a sufficient number of symptoms to permit localization. We simply verified the loss of sight first on the left and later on the right hand side and passing deafness on the right side. Under observation we noticed a slight diminution in hearing on the same side, a slight facial paresis on the right, also transitory psychic disturbances. He had had an attack with clonic convulsions more pronounced on the left than on the right side.

A simple roentgenogram of the cranium revealed nothing abnormal. The patient was venoluminal for 4 days and then arteriograms were made of both sides of the head. No reaction followed. Examination of the films showed that they were necessary in order to arrive at a correct diagnosis. On the left side the carotid system was normal. One could see the anterior cerebral artery (Fig. 5). The posterior cerebral artery P.C. was plainly visible as well as the middle cerebral artery in its normal position. The sylvian group was normal. On the right side (Fig. 6) we cannot detect the anterior cerebral artery. The middle portion of the sylvian group is displaced in an upward direction. With regard to the petrous bone it is on the left at a distance of 3 centimeters

and on the right at a distance of 6 centimeters. On this side an adventitious circulation goes down to ward the middle portion of the temporal lobe showing a stain T which can be seen very well.

Our diagnosis was meningioma of the middle part of the temporal lobe proceeding probably from the outer part of the dura mater. From the arteriograms the size of the tumor was estimated for it had caused a very considerable elevation of the sylvian group and had provoked at a distance compression of the anterior cerebral artery thus preventing the blood coming from the other side thus rendering the anterior cerebral artery visible on the left side.

Operation was done on April 19. After having cut open the right temporal region and having made the incision in the dura mater which did not pulsate we verified the existence of a tumor in the external middle portion of the temporal lobe adhering to the dura mater and sinking down into the brain. We isolated and extracted the tumor. Abundant hemorrhage was checked by means of tampons wet in hot physiologic serum.

The tumor which had the volume of a small mandarin (Fig 7) weighed 38 grams. The histological examination made by Mr. Ch. Oberling revealed that it was a tumor of a very special structure giving the impression of a glioma invading the meninges. The part involving the brain was a fibrillary structure in the part involving the meninges we were surprised at the extraordinary vascularity. This tumor appeared coarsely fibrillar and reminded us of the appearance of certain peripheric gliomata and even that of certain meningioblastomata.

In the present case we see the abundant circulation around the site of the tumor. Its localization is obvious but we cannot detect as in the previous cases referred to the tumor itself. The point is that this is another kind of tumor with considerable vascularity connected it is true with the meninges but rather a kind of glioma. Thus we have another type of tumor the diagnosis of which we were able to determine by means of arteriographic study. These latter tumors with which we have previously had some experience do not always show the same anatomopathological characteristics. They do however usually have an abundant circulation—a fact of help to the surgeon in making his diagnosis.

There is a third group of tumors which can also be diagnosed—the tumors without an abundant circulation.

CASE 3. Large cholesteatoma of the right temporal lobe. A V 27 years of age workman has been under observation since 1914. At that time he complained of epileptic crises. Before that he used

to have auras identical with those which always preceded his fits: sensation of heat in the entire left side of his body and ringing in the ears. At first these auras were not followed by convulsions. The luminal had no special influence over these crises which he continued to have more or less with the same intensity and frequency. He was admitted to our hospital in October 1927.

Patient fell down a flight of stairs when he was 11 years of age. Later on he had had typhoid fever and had expected blood. He decided to enter the hospital on account of his crises, his attacks of amnesia and especially on account of the loss of sight. He had headaches but no vomiting. Motility was normal. The crises were generalized but he turned his head to the right. At the end of one of these attacks at which we were present he continued to have convulsions on the right side when on the left side they had already ceased. The signs of Struempell passive flexion of the foot and Foré Marie were positive on the right side. The test of Oppenheim made on the left side caused the great right toe to move. The same test on the right side caused a very slight extension of the left side. On provoking the plantar reflex on the right we got the reflex of defence (shortening). Abdominal reflexes were diminished on the left side. Cremasteric reflexes were normal.

Sensation was normal save in a zone of the abdominal region where there was a hypoaesthesia. The olfactory nerve was normal on the left side and apparently slightly compromised on the right side. The patient did not identify smells very well on this side. The second nerve was compromised. The first ophthalmologic observation made before his admission into the hospital reads: Heavy optic papillitis with tumefaction on both sides apparently not of recent date. Patient had a passing diplopia (6 b). The other cranial nerves were normal. We made several examinations of the auditory nerve but found no difference in the right and the left sides. Taste was normal. Cerebellar functions were normal. Patient had a nystagmus when in extreme positions, rapid oscillations when turning the eyes to the left more pronounced but less rapid oscillations when looking to the right. He complained of not being able to do his work as before on account of his attacks of amnesia. No further mental disturbances were noticed.

The cerebrospinal fluid was under normal tension. Albumen normal. Pandy negative. Lymphocytosis 42. Benzon normal. BWR in blood normal.

A simple radiogram of the cranium revealed nothing abnormal. After an injection into the left carotid there was a slight dysarthria for 4 or 5 minutes followed by transitory verberation. The left arteriogram was normal (Fig 8). On the right side (Fig 9) the carotid siphon is pulled down and projected to the front. The circulation is reduced in the upper part of the siphon. The sylvian group is considerably deviated in an upward direction. Obviously there was a tumor in anterior

part of the temporal lobe. The slow growth of the neoplasm over a period of several years suggested a rather benign probably extirpable tumor. After the pictures were taken the patient felt better, saying that his sight had improved and he refused to be operated on. In spite of our advice he left the hospital. One year went by and on December 20, 1928, he came again to see us. He felt worse and had shortly before ceased to work. He noticed at times a slight trembling of the left arm and hand but on moving the arm rapidly to and fro this trembling ceased. Sight in the right eye was more reduced than in the left.

His tendinous reflexes were more or less the same but the signs of the *via pyramidalis* at this time differed. On the left side there was a positive Barre and sometimes a passive flexion of the foot, equally positive on the same side. On the right side only the signs of Babinski and of Rossolino were positive. On exciting the right plantar we observed only the extension of the great toe on the left side. On exciting the left plantar we observed a flexion of the toes on the left side and an extension of the great toe. There continued to be a slight disturbance of the olfactory nerve on the right side which resembled the disturbance at the first observation. The patient could identify smells perfectly well on the left side but on the right side he could not do so or hesitated in identifying them. An ophthalmologic examination on December 24, 1928, revealed Neurus on both sides but less clear and less tumid on the left side. No diplopia. The nystagmus continued with the same characteristics and intensity as in the first observation. The patient decided to be operated upon but he died before operation during an epileptic attack. Postmortem examination revealed the existence of a large tumor of the right temporal lobe—a cholesteatoma (Fig. 10).

In the present case the exact diagnosis would have been doubtful if it were based only upon clinical symptoms. The hemianopsia gave us later on new elements for the diagnosis but this hemianopsia was different from that described by Cushing. It was an incomplete hemianopsia of the upper and the lower quadrant and was more pronounced in the lower one.

The neurologic symptoms as the relative anosmia on the right and the turning of the head toward the right side during the epileptic seizures were rather suggestive of a localization on this side. The signs of the *via pyramidalis* detected during the first observation were however in favor of a localization on the left side. At the second observation the discordance of these signs did not justify an exact conclusion.

The epileptic crisis disclosed that the convulsions still continued on the right side after they had ceased on the left side. This is a peculiar feature which we have already observed as being a sign of localization on the right side but which until that moment made us believe in localization on the opposite side. The trembling of the left arm and hand noted in the second observation was another element in favor of localization on the right side.

Nystagmus with short rapid shocks when the patient directed his look toward the left but with greater and slower shocks when he looked toward the right permitted no sure conclusion. The integrity of the auditory nerve was also impressive. We have already explained our opinion about the cortical centers of audition.

Again in the present case the encephalographic arterial proof helped to determine the exact site of the tumor—an impossibility in the first clinical observation and in the second observation still doubtful.

CASE 4. Large tumor of the frontal lobes larger on the left extending to the midline and in living the pons. A M. S. 19 years of age had been under observation for 15 years. When 3½ years old he met with an accident falling down and striking his neck against a stone. No lesions resulted but his family noticed some days afterward lateral oscillations of the eyeballs. Then the boy became thin and 2 months after the accident he was brought to us because he had great difficulty in making movements on the left side. He had headache and vomiting. He had had repeated lumbar punctures at intervals. Patient had improved so that he was able to go to school until 14 years old when headache and vomiting reappeared. Again he became thin and walked with difficulty on account of the flexibility of the legs. His sight began to fail him. He had 2 generalized epileptic attacks one of which was so severe that his family thought him dead. Two years ago his face, body and arms began to get fat. We made 24 applications of X-rays over the hypophysis. Last year he seemed quite well except that he sometimes had attacks of hiccoughs. Headache and vomiting disappeared. There was complete blindness of the left eye but perception of light in right.

Present examination revealed adipoity of the body, arms and face where the *pilo* system was very little developed. The back and lower limbs were normal. Hair of the pubis and lower limbs was normal. On the thighs and legs there was even a certain hypertrophicosis for his age. From this point of view the contrast between the upper and lower parts of the body was a remarkable one. The testicles

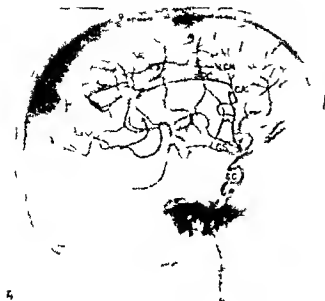


Fig. 2 Right arteriogram of brain Case 1. SC Carotid siphon GS sylvian group normal C1 anterior cerebral artery PC pericallosum artery and CM callosal marginalis artery in normal positions



Fig. 3 Left arteriogram of brain Case 1. Carotid siphon normal GS sylvian group considerably raised C1 Tumor 14 vessels of the new formation supplying the tumor

were normal. He had erections and had not lost the libido sexualis. Walking was impossible on account of flexion of the legs. It was impossible to reduce this flexion on account of the pain and heavy muscular contractions which were brought about by any such experiment. Movement of the upper limbs was normal but were accompanied by trembling. The tendinous reflexes were brisk and prompt both in the upper and lower limbs. The cremasteric reflex was normal on the right side and abolished on the left side. There was complete anosmia on the left. On the right side the patient recognized at times some smells. There was complete amaurosis on the left side. Perception to light on the right side. There was papillary stasis and afterward secondary atrophy of the optic nerves. There was slight facial paresis of the central type on the left side. There was almost complete deafness on the left side. On the right the patient does not hear well. The remaining cranial nerves were normal. No adiadochocinesis was present. Some nystagmiform movements were noted especially when the patient looked to the left. There was considerable euphoria. Patient was a little childish but showed no mental confusion. Examination of the cerebrospinal fluid showed tension continuously much increased at times xanthochromic albumen increased Pandy (+ + —) lymphocytosis 3 to 4 per cubic millimeter. A simple roentgenogram showed the sella turcica destroyed. The right arteriogram (Fig. 11) showed the pericallosum artery considerably raised. The extended anterior cerebral artery made a curve with concave toward the front. On this side was visible an upper circulation seeming to encircle the neoplasm. The left arteriogram (Fig. 12) revealed considerable lowering of sylvian group and disappearance of the frontal lobe circulation.

Evidently this was a case of a very large tumor without a very appreciable circulation of the left frontal lobe extending beyond the midline and invading the right frontal lobe. Its site must have been on the bone and it must have raised the corpus callosum considerably. A tumor of this size and this position was likely to involve the middle part of the cranium.

The patient's condition was not very serious but he insisted upon being operated upon. After explaining the circumstance to his family the operation was carried out in July last.

After cutting and laying open the left frontal lobe we found the tumor at once at the base of the frontal lobes more developed on the left side and extending toward the right. We opened it and found therein a cyst containing gelatinous matter. The state of the

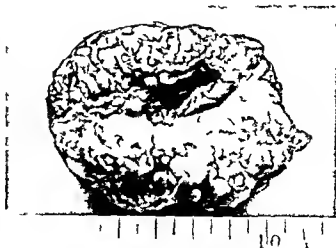


Fig. 4 Tumor removed in Case 1

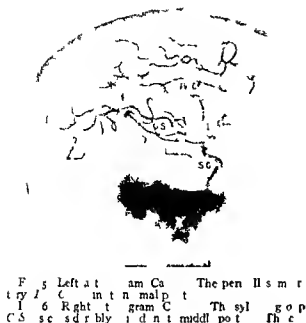
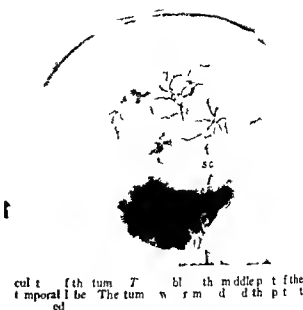


Fig 7 T m m d Ca



patient did not permit us to go farther. The skull bone was very thin. Patient died in the evening of the day of operation.

The postmortem examination revealed an enormous tumor (Fig 13) nestled at the bottom of the frontal lobes more on the left than on the right side and extending backward as far as the pons.

CASE 5. Tubercle of the base on the level of the free part of the temporal lobe. Manuel J. M., 23 years of age, farmer. Patient had severe headaches in August 1928 and had vomited for 1 month. On

being admitted to our hospital on December 19 he complained still of severe headache and of sensations of nausea. A week after the beginning of these cephalalgias he noticed that his sight became very much reduced on both sides. He had had no difficulty with his ears save some ringing on both sides sometimes of great intensity. He had never had attacks of disturbance in movements. General state was bad and he was anemic. He had a weak pulse with bradycardia. To provoke the patellar reflexes it was necessary to use the Jendrassik maneuver. The achillean reflexes were unobtainable. The tendonous reflexes in the upper limbs were also unobtainable. The plantar reflexes were present in flexion. Abdominal and cremasteric reflexes were a little more pronounced on the left side. The patient appeared slightly apathetic and somewhat reserved. The percussion of the head revealed that he felt the same pain on both sides. The cranial nerves were all normal save the second, vision very reduced, tumor and d. hemorrhagic neuritis.

An examination of the cerebrospinal fluid showed that the protein was much increased, the fluid pouring out without interrupt. Albumin was very much increased (andy) (+ + + +). Lymphocytes 20 per cubic millimeter. Benign organisms 32, 3, 0, 0, 0. Urine as normal. The roentgenograms revealed the obliquity of the clivoid process.

On the right roentgenogram (Fig 14) the aspect was more regular, no meninges but the outline of the Sylvian group appeared slightly altered.

In the roentgenogram of the left side (Fig 15) the Sylvian group appeared suddenly displaced by about 3 centimeters above its normal position. The posterior temporal artery (Fig 16) deduced rapidly that no meninges were present. The roentgenogram of the curved fold

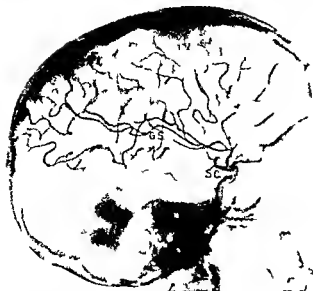


Fig 8 Left arteriogram Case 3 Normal

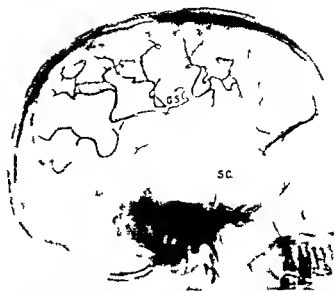


Fig 9 Right arteriogram Case 3
 elevation of the sylvian group GS in the anterior part

The carotid siphon SC is nearly destroyed. There was considerable loss of circulation in the fore part of the brain. Cholesteatoma of the anterior part of the temporal lobe.

remained much more raised. The diagnosis we made was probable tumor on the level of the former part of the left temporal lobe deeply set and probably clinging to the base of the cranium going up to or even a little beyond the middle line. The existence of the tumor on the left side and in the temporal region was not to be doubted. It could readily be verified by a glance over the two arteriograms (Figs 14 and 15). Besides the tumor was evidently deep in the temporal lobe because the posterior temporal artery TP which is the most superficially placed one descended rapidly to its normal position. This meant that quite likely the external part of the temporal lobe was not affected. The tumor was supposed to be situated at the base of the cranium pressing on internal part of temporal lobe with its arteries. It probably extended to the midline.

Operation was done on January 18 and local anesthesia was used. A musculocutaneous shield in the left temporal region was cut open. In order to get well down to the temporal hole we began the temporary resection of the zygomatic process. We resected the temporal shell as close to the base as possible. No pulsations of the dura mater were noticed. Incision revealed great tension. Glucose solution was injected. Extraction of 25 cubic centimeters of cerebrospinal fluid by means of the lumbar puncture was done. The brain cortex was found to be normal. We immediately explored the base by introducing a finger between the brain and the base of the cranium. We detected at once approximately within an inch from the origin of the sylvian fissure and at a distance of about 2 or 3 centimeters from the periphery a hard tumor (Fig 16) not adherent to the dura mater. The tumor was deeply set and seemed to extend to the middle line. Slowly we isolated it. The histological examination showed that it was a tuberculoma.

This patient remained in our hospital until May 1930 i.e. 1 year and 4 months after the operation. He is getting on very well; his sight has improved to such an extent that we have authorized him to take up his usual work again. The last ophthalmologic examination made on April 17 1930 discloses that

The right eye detects the fingers at a distance of 1 meter. The vision of the left eye is greatly improved. In December 1928 the patient did not see the fingers unless they were placed close to the eye. On February 13 1929 he was able to see them on the left at a distance of 5 meters. The optic nerves and the vessels of the retina are in approximately the same state.

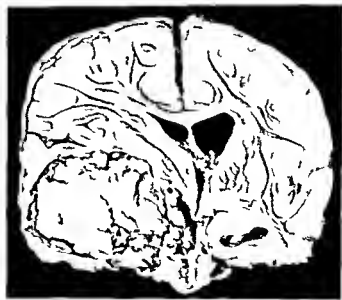


Fig 10 Cholesteatoma of the right temporal lobe
 Case 3



Fig. 3. Brain tumor, 4. Ap. P. f. c. s. d. b. l. p. p. o. t. u. h. b. e. m. e. d. f. m. t. h. l. f. t. d. (p. p. n. g. t. d. f. p. c. t.)

The diagnosis was confirmed in all its particulars by the operation. This case is specially interesting as there were no factors on



Fig. 4. Brain tumor, 4. Ap. P. f. c. s. d. b. l. p. p. o. t. u. h. b. e. m. e. d. f. m. t. h. l. f. t. d. (p. p. n. g. t. d. f. p. c. t.)



Fig. 5. Brain tumor, 4. Ap. P. f. c. s. d. b. l. p. p. o. t. u. h. b. e. m. e. d. f. m. t. h. l. f. t. d. (p. p. n. g. t. d. f. p. c. t.)

which to determine localization. The neurologic observation revealed nothing but the roentgenogram showed that the anterior and posterior clinoid apophyses were destroyed. The patient had no symptoms caused by disturbances of the infundibulohypophyseal region. It is well known that the clinoid processes can be destroyed by a tumor located at some distance from them. The flattening of the sella turcica as well as the complete disappearance of the clinoid processes was also in favor of an extrasellar tumor (John Camp). Beclere says in his report to the ninth Reunion Neurologique: "Whatever the site of the extrasellar tumor in the interior of the cranium may be and be they near or distant the deformities brought about by them have the same general aspect and do not in themselves make possible localization of these tumors." In the present case we had a juxtasellar tumor placed behind the posterior clinoid process which was clearly revealed by the arterial encephalogram. The diagnosis was absolutely precise and the operation in the region indicated was conducted in such a way as to permit extraction of the brain tumor. Successful operations upon these tumors of the brain base are rather rare except in the case of tumors of the hypophyseal region. Without an accurate diagnosis it is always very difficult to extract them.

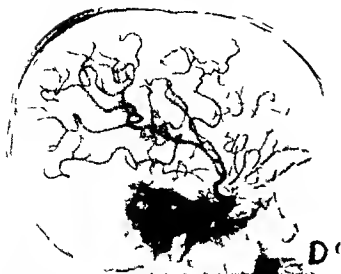


Fig 14 Right arteriogram Case 5. The carotid siphon SC is normal. The sylvian group GS is slightly raised in the middle part

Fig 15 Left arteriogram of Case 5. The carotid siphon is stretched out and the sylvian group GS is raised. The



arteries of the curved fold and the posterior parietal artery are considerably raised. The temporal arteries fall rapidly down to their normal position. Tuberculoma of the mid portion of the temporal lobe reaching to the midline. Removed. Cured.

This case has shown us that a brain tuberculoma can be extracted and that the patient can recover his health (Fig 17). We have been convinced that the prognosis in brain tuberculomata is not so bad as that of large cerebellar tuberculomata.

In the present observation which we believe is unique in the medical literature a large tuberculoma of the brain base was successfully extracted and the patient recovered. The patient was under observation for 18 months and left the hospital in good health. Such a favorable result cannot help but encourage us to ablate at least tuberculomata of the brain. We must remember however that we could not have been so successful in extracting the tumor so easily had it not been

for the diagnostic precision obtained through the encephalographic films.

The film revealed the absence of circulation in the last two tumors which belong to the third group of neoplasms in which the arteriographs of the brain have made possible the localization of the growth i.e. in cholesteatomata, hydatid cysts, tuberculomata, some glomata, etc.

SUMMARY OF OBSERVATIONS

When we began our studies in arterial encephalography we gave special attention to the dislocation of the sylvian group as we believed they were especially capable of revealing the existence of a subjacent tumor. And this for two reasons: (1) the sylvian group is



Fig 16 Tuberculoma removed



Fig 17 Patient 1 year after operation



Fig 8 Right t n gram Ca 6 Th arot d ph n
SC ml Th yl ia g p d l hly th
md p t Th P Cr pencall um rt ry s c
d bly d l the p t p t
Fig 9 Left t n gram Ca 6 Th arot d ph n

SC as ml Th yl ia g p GS ra d sl hly
l the middle p t Th c l t l th tum the
l l with the middle p t f the yl g p corr p d
t th p l gla d Th p c l l m a t r y P C
s ble l th d a d a e d t a d the rear

constantly visible normally showing the same direction and similarity of constitution (2) the first arteriograms made did not reveal any of the aspects later discovered in the course of our experiments namely visibility of the adventitious circulation of some tumors and visibility in certain cases of the anterior cerebral artery and its ramifications

In the dislocation of the sylvian group we have been able so far to locate and make accurate diagnoses in 18 cases of brain tumors and of these 14 were confirmed by the operation the 4 remaining not having been operated upon. The direct visibility of the arteries was observed in 13 cases of these 9 were operated upon

We have recently tried to determine why the anterior cerebral artery is not always visible and we were able to come to some conclusions which appear to us to be of the utmost importance in making a diagnosis

When there is a tumor of certain volume in one of the brain halves it is sometimes possible to see the anterior cerebral artery on the opposite side. Through compression the tumor prevents the regular circulation and the anterior communicating vessel ceases to take the blood from the compromised half of the brain to the opposite side because of the diminution in pressure in the anterior cerebral

artery of that side. The same is true when opaque liquid is introduced into the artery by means of an intracarotid injection. When this liquid is injected on the opposite side as the blood does not come from the side where the tumor exists we can see as a rule not only the sylvian group but also the anterior cerebral artery where the concentration of the iodide is not reduced by being mixed with the blood coming through the communicating artery. This point—the unilateral visibility of the anterior cerebral artery—is of certain value in making a diagnosis

In the arteriograms obtained by the technique of temporarily stopping the blood in the internal carotid we sometimes see the anterior cerebral arteries on both sides. This fact at first seemed to be due simply to technique—an injection made more quickly—and it puzzled us for a long time. Now we are convinced that the phenomenon of visibility of the anterior cerebral artery on both sides can be brought about in very exceptional cases by an abnormality of the brain

The anterior cerebral artery must always be visible when the corresponding artery of the opposite side does not cause an overflow of blood into it during the injection of iodide of sodium so as to reduce the concentration of this latter by more than 8 to 10 per cent. But

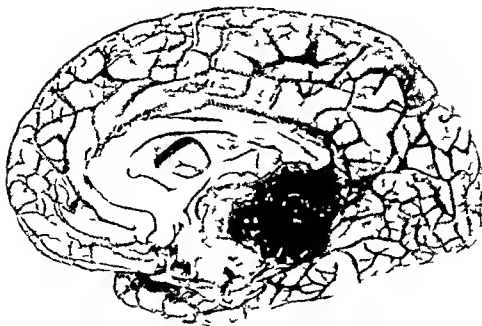


Fig. 20. Tumor of the pineal region, right half. The plenum of the corpus callosum is elevated thus causing the elevation of the terminal part of the pericallosum artery in the posterior part.

such cases of anatomical abnormality of the anterior communicating artery (very reduced size) are rather rare. Consequently it was necessary that there should be some pathological reason to account for the relatively frequent visibility of the anterior cerebral artery on both sides. After prolonged observations we came to the conclusion that considerable dilatation of the ventricle or the presence of a tumor compressing the anterior communicating artery apart from the two anterior cerebral arteries rendering it difficult for the blood to pass from one to the other owing to the stretched and decreased size of the communicating artery must be the reason of the visibility of the two anterior cerebral arteries. Tumors of the central region of the brain, for instance of the third ventricle, of the pineal region, and of the quadrigeminal tubercles must fall in this class. As soon as we obtained some proof that this hypothesis was undoubtedly true we tried to utilize dislocations of the arteries connected with the anterior cerebral artery as a means of diagnosis.

The importance of this new interpretation of arteriograms seems to us to be of the utmost importance inasmuch as tumors of the central regions offer as a rule very deficient clinical symptomatology.

The anterior cerebral artery entering the interhemispherical cleft and furnishing by its convexity the orbital and frontal arteries adjusts its course to the corpus callosum going partly around it and in general follows the channel between the corpus callosum and its circumvolution, i.e. the so called sinus of the corpus callosum. Very often its forward part goes around the corpus callosum for a distance, passes over the corpus callosum circumvolution and descends down to the channel or sinus of the corpus callosum where it enters in order to reach the splenius.

In this part of its course in which it is called the posterior cerebral artery it ramifies into various branches which lead to the circumvolutions of the internal face of the brain. On going around and through the upper portion of the brain these branches also irrigate in part the convex portion of the brain half way to the calcarate fissure. In the arteriograms the median cerebral artery is situated over the posterior cerebral artery.

CASE 6. Visible tumor of the pineal gland. Henrique S. G. 34 years of age, workman, March 1930 came to consult us at our Neurological Department. He had had severe headaches which began some 3 months before he came to see us. These headaches were more intense in the occipital region. He had

attacks of vomiting. One month after the headaches began he noticed impairment of sight and hearing. When observed for the first time he was practically blind. Vision was reduced by 5/100 on the right side and more reduced still on the left side. Deafness at that time already very pronounced increased rapidly until it became complete.

Right patellar reflex was abolished. The left one very weak. Achillean reflexes were abolished on both sides. Tricipital and radial reflexes were weak on left and abolished on right side. Abdominal and cremasteric reflexes normal. Plantar reflexes noticed in flexion. No signs of the *via pyramidalis*.

The left eye showed a heavy papillary stasis with hemorrhages. In the end complete amaurosis. As to the seventh cranial nerve at times a slight facial paresis of the central type was noticed on the right but this disappeared without leaving a vestige. As to the eighth nerve there was a very pronounced diminution of audition at the time he entered the hospital which some time later became complete. Cerebellar functions were normal. No vertigo or nystagmus was found. Psychological disturbances were slight. The patient said he had a continuous desire to urinate but that it was not necessary to do so. Deafness and amaurosis prevented us from making a thorough examination of his mental state. We were however under the impression that there was a pronounced psychological deficiency. He used to utter somewhat strange and stereotyped phrases. In the terminal phase torpor and drowsiness were present.

The right arteriogram (Fig. 18) was normal in the region of the sylvian group. We could detect the anterior and the pericallosal artery. The left arteriogram (Fig. 19) showed considerable vascularity in the posterior half of the sylvian group which appeared in its normal position. On this side we could also see the anterior cerebral artery with its ramifications. On both arteriograms the pericallosal artery was raised in the posterior part.

Taking especially into account the marked vascularity in the left sylvian group we made a diagnosis of a very vascularized deep tumor of the middle part of the brain on the level of the third ventricle. We believed that it was a central one. It did not dislocate the sylvian group on either side but it did raise the splenium of the corpus callosum. We decided that the tumor was a vascular edgema.

The operation was carried out on March 8, 1933. Because it was impossible to reach the region of the tumor we resolved to do a decompression. The patient showed slight improvement at first but became worse and died a month after the operation.

The postmortem examination revealed the existence of a large vascularized tumor of the pineal gland and the corpora quadrigemina at the level of the third ventricle and was situated under the splenium.

The diagnosis was made fairly accurate although this was the first case we had had of a

tumor in this region. Clinical symptoms which might enable one to localize the growth were absolutely missing. The patient had had no trouble which might be considered as the result of the destruction of the pineal gland. We can say almost the same referring to the corpora quadrigemina.

The histopathological examination made in the Anatomopathological Institute of Paris by Prof. Ch. Oberling revealed that it was a case of ependymoma.

The arteriographic diagnosis of this case is one of the most interesting of our collection is worthy of some consideration. The visibility of the tumor due to the vascularity on the level of one of the sylvian groups revealed a curious aspect in the circulation of brain tumors. In meningioblastomata diagnosed by means of encephalographic proof we have found that these tumors have not only a circulation arising from the meningeal arteries but also an accessory circulation proceeding from one of the branches of the internal carotid which becomes visible in the arteriograms.

In the last case described only one of the sylvian groups supplied the tumor with an abundant system of blood vessels although both sylvian groups were at the same distance from the neoplasm. The first arterial neoformation caused the unilateral circulation of a central tumor.

Were there also vessels proceeding from the posterior cerebral artery? This artery becomes visible only in abnormal cases when the posterior communicating artery does not really exist as it is reduced to an insignificantly small size. In this case it is not visible. Therefore we do not know whether it contributed to the vascularity of the tumor although this does not seem to us very probable. Vascularity of tumors especially of brain tumors through arteriography has been found a valuable means of study.

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A STUDY OF THE EFFECTS OF DIVISION OF THE CERVICAL ŒSOPHAGUS OF THE DOG

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 F m the D partm t of urg ry dPhy of gy tV d hlt U ty

HADEN and Orr (2), Wangenstein and Chunn Andrus and Donnelly have found that complete obstruction of the œsophagus of the dog produces death in from 1 to 3 days. Studies on the blood after occlusion of the œsophagus showed that there is usually an increase in the non protein nitrogen and urea nitrogen and a decrease in the chloride content. These alterations were not sufficiently constant or great to indicate that they were responsible for the early death. Andrus and Donnelly state that dogs with fistulæ of the œsophagus die in almost as short a time as those in which the œsophagus is simply obstructed. These findings suggest that the loss of fluid causes the death of dogs after complete occlusion of the œsophagus. Pavlov was able to keep dogs alive which had fistulæ of the œsophagus by feeding them through a tube placed in the stomach. He states 'In the year 1889 we performed the operation of œsophagotomy on a dog already possessing a gastric fistula that is to say we divided the gullet in the neck and caused both its divided ends to heal separately into an angle of the skin incision. We thereby accomplished the complete anatomical separation of the cavities of the mouth and stomach. Dogs so operated upon recover perfectly with careful nursing and live many years in the best of health. In feeding their food must naturally be brought directly into the stomach.

If the loss of fluid as saliva is responsible for the death of animals after the œsophagus is obstructed a concentration of the blood a decrease in the blood volume and a decrease in the content in water of the tissues of the body would be expected. It was for the purpose of studying these points that these investigations were undertaken. For purposes of comparison similar studies were made as to the effects of food and water deprivation and as to the effects of the graded removal of

blood plasma and of whole blood while the animals were deprived of food and water.

METHODS

Dogs were used in all experiments. The dye method which was described by Keith Rowntree and Geraghty was employed in determining the blood volume and plasma volume. The hæmoglobin was determined by the Newcomer method (5) with a Bausch and Lomb hæmoglobinometer. The chloride content was determined by the method of Whitehorn (8). Samples of blood and muscle were obtained at the beginning and at the termination of the experiments for studies on the content in water. Blood was withdrawn from the femoral vein. Muscle was obtained from the pectoral and one of the flexor muscles of the thigh at the beginning of the experiments and from symmetrical sites on the opposite side of the body at the termination. The specimens of muscle which usually varied in weight from 1 to 2 grams were placed in beakers of known weight and cut into small pieces in order to facilitate drying. After weighing the heater containing the blood or muscle it was placed in an oven the temperature of which was kept at as nearly 105 degrees centigrade as possible. After 48 hours it was again weighed and the content of the tissues in water and solids was determined.

During the operations which were performed in order to occlude the œsophagus the animals were anesthetized with ether. The control determinations were performed before the anesthetic was begun. The œsophagus was exposed and isolated in the cervical region. Two ligatures of heavy tape were placed at a distance of about 2 centimeters above and below the level at which the œsophagus was to be divided. Two ligatures of catgut were placed between these and the œsophagus was divided. The animals were observed from time to time

TABLE I—THE EFFECTS OF DIVISION OF THE OESOPHAGUS

| Epe m t | T m f d t e m u t | Wt d g kg | H mo- gl b pe t | R d blood il ount | Plasma vol m cm | Blood l m cm. | Blood h d t mgm per cc | R mark |
|------------|------------------------|-----------------|-----------------------|----------------------|-----------------------|---------------------|---------------------------------|--------------------------------|
| | C t l | 8 | 85 | 683 000 | 537 | 84 | 554 | |
| | 6 hrs 3 mu after pe ti | 685 | 9 | 7680 000 | 39 | 605 | 558 | Ded p ximat ly 63 hours after |
| | 5 hr fte pe t | 67 | 95 | 749 000 | 369 | 617 | | |
| | Co t l | 666 | 9 | 764 000 | 45 | 73 | 548 | |
| | 6 hrs f p | 56 | 08 | 86 000 | 334 | 79 | 54 | D d pp ximat ly 56 hours f |
| | 8 h ft pe ti | 555 | | | 5 | 405 | | |
| | Co t l | 47 | 5 | 768 000 | 759 | 53 | 55 | |
| | 4 hr after pe ti | 397 | 8 | 947 000 | 500 | | 49 | Ded pp ximat ly 60 hours after |
| | 8 h aft per | 33 | 35 | 997 000 | 5 | 84 | 44 | |
| | Co tr l | 7 | 95 | 77 000 | 88 | 58 | 55 | |
| | h aft per | 6 | 00 | 89 000 | 7 | 350 | 467 | D d pp ximat ly 6 h w after |
| | 8 hr f pe t | 35 | 00 | 7900 000 | 59 | 33 | 65 | |
| | Co tr l | 633 | 88 | 66 000 | 900 | 668 | 470 | D d 4 h rs aft pe |
| | 4 hr ft pe tiom | 5 | 9 | 6800 000 | 657 | 63 | 6 | |
| | Co tr l | 8 | | | 699 | 5 | | |
| | C tr l | 5 | 78 | 68 000 | 680 | 97 | 508 | D d pp ximately 60 h urs after |
| | h after pe ti | 9 | 8 | 55 000 | 476 | 75 | 573 | |
| | 3 hr fte p ti | 9 | 85 | 600 000 | 45 | 68 | 515 | M blood p sur 97 mm. hg |
| | Co tr l | 47 | 5 | 7680 000 | 759 | 574 | 56 | |
| | 4 hr ft per ti | 397 | 8 | 947 000 | 56 | 4 | 449 | D d pproximat ly 38 h urs af |
| | Co tr l | 7 | 95 | 77 000 | 884 | 585 | 53 | D d pp m t ly 38 h ur af |
| | 3 hr ft per ti | 6 | 00 | 89 000 | 7 | 358 | 67 | |

until they appeared to be in very poor condition the blood pressure was determined and the studies which had been performed before the operation were repeated.

Since these animals were unable to swallow food or water studies were performed upon other dogs which were simply deprived of food and water for 80 hours. This was the upper limit of the duration of the experiments in which the oesophagus was divided. After the control determinations had been performed the dogs were anesthetized for 1 hour by ether as were those in which the oesophagus was divided. Samples of muscle were obtained while the animals were anesthetized. No food and water was given for 80 hours and the studies were repeated.

In the next group of experiments food and water were prohibited and blood plasma which equalled $\frac{1}{2}$ of 1 per cent of the body weight was removed at 8 hour intervals in some ex-

periments and at approximately 12 hour intervals in others. Determinations were made at the beginning and end of the experiments. These experiments were usually of shorter duration than were those in which the oesophagus was divided. At 8 or 12 hour intervals whole blood which equalled 1 per cent of the body weight was removed from the femoral artery. This was defibrinated and centrifuged and red blood cells plus enough plasma to equal one half of the volume of blood that had been removed were re-injected. Plasmapheresis was continued at the stated intervals until the condition of the animal became alarming. At that time the blood pressure was determined and the last studies were performed.

In the next group of experiments the animals were deprived of food and water and whole blood which equalled 0.5 per cent of the body weight was removed at approximately 12 hour intervals. Studies were performed

TABLE II—THE EFFECTS OF DIVISION OF THE OESOPHAGUS ON THE WATER CONTENT OF BLOOD AND MUSCLE

| Expt no | Time of observation | Wt dog kg | Max bp mm hg | Blood wt of 100 cc | Pct of water in blood | Flesh wt of 100 g |
|------------|-------------------------------------|--------------|-----------------|-----------------------|--------------------------|----------------------|
| 1 | Control period | | | 78.85 | 73.54 | 78.2 |
| | 48 hrs after division of oesophagus | | 0 | 77.6 | 70.00 | 67.70 |
| 2 | Control period | | | 79.7 | 75.45 | 74.58 |
| | 48 hrs after division of oesophagus | | 6 | 78 | 75 | 79 |
| 3 | Control period | | | 86 | 77.6 | 77.8 |
| | 48 hrs after division of oesophagus | | 60 | 85 | 73.9 | 73.7 |
| 4 | Control period | 9.5 | | 8 | 75 | 75 |
| | 4 hrs after division of oesophagus | 8 | | 78 | 73.5 | 73.00 |
| 5 | Control period | 4.0 | | 77.9 | 75.9 | 74.7 |
| | 48 hrs after division of oesophagus | 3.80 | 7 | 75.35 | 73.75 | 74 |

TABLE III—THE EFFECTS OF FOOD AND WATER DEPRIVATION FOR EIGHTY HOURS

| Expt no | Time of deprivation in minutes | Wt dog kg | Max bp mm hg | Hb pct | Red blood cells | Plasma volume ml | Plasma protein g | Blood volume ml | Plasma protein g | Chloride content mg per 100 ml | Percentage of body weight | | |
|------------|--------------------------------------|--------------|-----------------|-----------|--------------------|------------------------|------------------------|-----------------------|------------------------|---|---------------------------|--------------------|---------------------------|
| | | | | | | | | | | | Blood | Pectoral muscle | Flexor muscle thigh |
| 1 | Control | 13.41 | | 73 | 468,000 | 873 | | 46 | | | | | |
| | Control | 3.3 | | 80 | 500,000 | 797 | | 46 | | 5.6 | 70 | 63.9 | 68.75 |
| | 80 hr later | 8.9 | | 0 | 680,000 | 586 | 0.8 | 7 | 18.5 | 674 | 78.99 | 63.8 | 68 |
| | Control | 9.2 | | 8 | 643,000 | 64 | | 0.6 | | | | | |
| | Control | 9.4 | | 8 | 65,000 | 3 | | 34 | | 5.6 | 78.8 | 78.5 | 75 |
| | 80 hr later | 8 | 15 | 95 | 8,000,000 | 194 | 0.9 | 74.5 | 3.4 | 68 | 78.8 | 7 | 7.3 |
| 3 | Control | 6 | | 85 | 685,000 | 86 | | 44 | | 579 | 79 | 73.95 | 73.55 |
| | 8 hr later | 5.8 | 15 | 9 | 84,000 | 739 | 8.3 | 3 | 8.34 | | 77.9 | 7.8 | 7.75 |
| | Control | 6.8 | | 9 | 7,000,000 | 964 | | 60.6 | | | | | |
| 4 | Control | 16.77 | | 9 | 7,000,000 | 95 | | 583 | | 600 | 70.8 | 75.5 | 73 |
| | 80 hr later | 15.15 | 5 | 00 | 5,000 | 74.5 | 80 | 46 | 9 | 683 | 8.2 | 7.5 | 7.7 |

Analysis of food and water intake during the period of deprivation. The amount of food and water consumed during the period of deprivation is shown in the following table.

before the first removal of blood and after the blood pressure had been reduced to a fairly low level by the loss of blood. These experiments were of slightly longer duration than were those in which the oesophagus was divided.

RESULTS

Division of the oesophagus The length of time which elapsed between the division of the oesophagus and the last determinations varied from 23 to 48 hours. The blood pressure was not determined in most of these experiments but the pulse rate was very fast and the condition of the animals very poor at the time of the last determinations. The animals lost as

an average 10.23 per cent of the body weight during the period of observation. The haemoglobin and the red blood cell count increased in all experiments. There was a marked decrease in the blood volume in all experiments and most of the decline was due to the reduction in the volume of plasma. In most of the experiments there was some reduction in the chloride content but in no instance was this very great. The content in water of both blood and muscle was decreased in all experiments in which it was determined. The results of all of the experiments on division of the oesophagus are given in Tables I and II.

TABLE V—THE EFFECTS OF FOOD AND WATER DEPRIVATION AND OF HEMORRHAGE

| Ex per i m e n t | T'm of d i s t r i b u t i o n | Wt dog kg | M b p mm hg | Hb per cent | R d blood cells | Plasma of red cm | P l m l u m | Blood urea m | P e n t blood l m | Chl d co t e m g r a m c m | P e n t n a t | | | A m t blood m d i n p r e t a b o d y w e i g h t | T t l a m o u t e m e d c p t g e b w e i g h t |
|------------------|--------------------------------|-----------|-------------|-------------|-----------------|------------------|-------------|--------------|-------------------|----------------------------|---------------|-----------|-----------------|---|---|
| | | | | | | | | | | | Blood | P t o m l | F l m l t h g h | | |
| | Co t l | 12.5 | | 78 | 6,000,000 | 6.6 | | 916 | | 622 | 84 | 75 | 74 | 0.5 p e r c e n t | |
| | 60 hrs l t | 84 | | 45 | 3,500,000 | 430 | 9 | 59 | 36.3 | 659 | 87.5 | 71.65 | 72 | | 3 |
| | Co t l | 4.06 | | 83 | 7,500,000 | 65 | | 975 | | 57 | 77.7 | 73.8 | 74.85 | 5 p e r c e n t | |
| | 6 hrs l t | | | 68 | 5,000,000 | 537 | 18.4 | 803 | 9.7 | 64 | 81.00 | 73.5 | 74 | | 3.0 |
| 3 | Co t r l | 11.93 | | 71 | 4,650,000 | 685 | | 5 | | 5 | 8.55 | 73.9 | 75.4 | 0.5 p e r c e n t | |
| | 60 hrs l t r | 5 | 98 | 55 | 86,000 | 519 | 19.85 | 85 | 3.3 | 603 | 8.70 | 7.80 | 73.75 | | 3 |
| 4 | Co t r l | 13.80 | | 74 | 5,650,000 | 73 | | 5 | | 50 | 8.9 | 73.4 | 74.9 | 5 p e r c e n t | |
| | 60 hrs l t r | 6 | | 53 | 1,800,000 | 447 | 48.75 | 385 | 47.55 | 7 | 85.70 | 7.85 | 73.5 | | 3 |

volume and the blood volume decreased. The decrease in the plasma volume was approximately the same as in the experiments in which the oesophagus was divided but the decrease in the blood volume was greater. The content in chlorides decreased in most of the experiments. The content in water of blood and skeletal muscle decreased in most of the experiments in which it was determined. The results of these experiments are given in Table IV.

Food and water deprivation and removal of whole blood. The duration of the experiments in which whole blood was removed at 12 hour intervals from animals deprived of food and water was 60 hours. The total amount of blood removed from each animal equalled 3 per cent of the body weight. Although the blood pressure was not low at the termination of three of the four experiments the extremely fast pulse and the general appearance indicated that the animals were very sick. The loss in weight (11.79 per cent) was approximately the same as in the experiments on the oesophagus. The red blood cell count and the hemoglobin decreased greatly in all experiments. The plasma volume and the blood volume decreased markedly the decline in the volume of red blood cells being greater than that in the plasma. The decrease in the total blood volume was definitely greater than was found in the experiments in which the oesophagus was divided but the diminution in the plasma volume was slightly less than was found in the oesophagus experiments. The

content in chlorides increased in all experiments. The content in water of the blood increased in all instances and that of muscle decreased. The results are given in Table V.

DEDUCTIONS

A comparison of the results which were obtained in the different types of experiments shows that approximately ten per cent of the body weight was lost in all of them. As has been stated previously the experiments upon food and water deprivation alone were approximately twice the duration of the experiments on the effects of division of the oesophagus. The more rapid loss of weight in the latter experiments was probably due to the loss of saliva. There was an increase in the red blood cell count and the hemoglobin in practically all of the experiments except those in which whole blood was removed. Likewise there was a decrease in the content in water of blood and skeletal muscle in most of the experiments except those in which whole blood was removed. In these the water content of blood increased and that of muscle decreased. The alterations in the content in chlorides were not very great in any of the experiments. In the experiments on the effects of division of the oesophagus and on the effects of removal of plasma associated with food and water deprivation there was usually a small diminution in the chloride content. In the experiments in which the animals were simply deprived of food and water and in those in which whole blood was removed under similar conditions

TABLE VI—THE PERCENTAGE DECREASE IN BLOOD PLASMA AND BLOOD VOLUME AFTER THE VARIOUS PROCEDURES

| Type of method | Percentage of method | Percentage of method | Percentage of method | Percentage of method | Percentage of method | Percentage of method | | |
|----------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----|---|
| D. esophagus | | | 33 | 7 | | | | |
| | | 8 | 7 | 3 | 75 | 9 | | |
| | | 5 | | | 8 | 9 | | |
| | | 8 | 9 | 7 | 100 | | | |
| | 5 | | | | 6 | | | |
| | 6 | | | 38 | 8 | | | |
| | | | 7 | | 69 | 8 | | |
| | 8 | 5 | 97 | 3 | 76 | 7 | | |
| W. d. food | A. S. | | 3 | | 79 | 5 | | |
| | | 80 | 48 | 8 | 9 | 6 | | |
| | | 8 | | | 5 | 7 | | |
| | | 8 | 8 | 8 | 55 | 8 | | |
| | | 8 | 8 | | 6 | | | |
| | A. S. | | 6 | 78 | 65 | | | |
| | | 36 | 65 | 3 | 6 | 6 | | |
| | | 6 | 655 | 36 | 7 | 5 | | |
| W. d. food | | 3 | 8 | 57 | 9 | 9 | 6 | |
| | | | 6 | 46 | 76 | 7 | 8 | |
| | | 8 | 5 | 8 | 9 | 7 | 6 | |
| | | 6 | 5 | 45 | 9 | 57 | | |
| | | 7 | | 3 | 35 | 67 | 8 | |
| | A. S. | | 3 | 66 | 97 | 68 | 6 | |
| | | | 60 | | 6 | 3 | 9 | |
| | | | 60 | 8 | 7 | 56 | 6 | |
| W. d. food | | | 6 | 9 | 8 | 5 | 56 | 9 |
| | | | 6 | 575 | 47 | 5 | 5 | |
| | A | | | 9 | | 7 | 4 | 7 |

there was usually a small increase in the chloride content. The greatest average decrease in the total blood volume was found in the experiments in which whole blood was removed, the next in those experiments in which blood plasma was removed, and next in order were those in which the oesophagus was divided. The average diminution in the plasma volume was slightly greater in the experiments upon plasma removal than in those on oesophagus ligation, while that in the experiments

on the effects of removal of whole blood was slightly less. In the experiments on the effects of division of the oesophagus 80 per cent of the diminution in the total blood volume was due to the loss of plasma. In the experiments on plasma removal it was 69 per cent in those on the removal of whole blood it was 49 per cent and in the experiments on food and water deprivation alone it was 65 per cent. The comparative figures for the different types of experiments are given in Table VI.

The division of the cervical oesophagus and the graded removal of blood plasma from dogs deprived of food and water produced results quite similar in character. Both were associated with approximately the same loss in weight, an increase in the red blood cell count and haemoglobin, a slight diminution in the content in water of blood and muscle, and approximately the same degree of diminution in the total volume of plasma. The only definite difference was that the reduction in the total blood volume was greater in the experiments on the removal of blood plasma than in those on division of the oesophagus.

These experiments indicate that the cause for the early death after division of the oesophagus is the loss of fluids. The plasma constituted a smaller part of the total blood volume in these experiments than in those in which plasma was removed repeatedly. Wangenstein and Chunn believed that the explanation for the death of dogs with obstruction of the upper part of the intestines was due to the dehydration and loss of chlorides. Haden and Orr (2) in discussing their own results state: "These results indicate that a fatal intoxication ensues after the cardiac end of the stomach or the oesophagus is obstructed. The clinical course is more rapid and the blood changes are more marked than those occurring subsequent to pyloric or high intestinal obstruction. There is a severe toxæmia as evidenced by the high level of the non-protein nitrogen in the blood. It would seem that the toxic agent must have arisen distal to the obstruction. No further evidence for the action of a toxin is given by them except that sodium chloride which they believe to have a detoxifying action was found to prolong the life of dogs after obstruction of the cardiac end of the stomach."

Three animals in which the cardiac end of the stomach had been obstructed were given subcutaneously 40 cubic centimeters per kilogram body weight of one per cent sodium chloride at varying intervals. They state (3) 'The animals survived 32, 36 and 45 days. At autopsy in each the tape had cut through thus re-establishing continuity.' Instead of a detoxifying action it seems more likely that the sodium chloride saved the animals by maintaining the blood volume at a fairly high level until sufficient time had elapsed for the lumen of the cardia to be restored. After this the secretions from the salivary glands were able to pass into the stomach. The fact that the higher the obstruction is made in the intestinal tract the shorter the length of life is strong evidence in favor of dehydration as being the cause of death. Dogs with obstruction of the pylorus of the stomach live longer than those with obstruction of the cardiac end or of the oesophagus because fluids can reach the stomach under the former condition where they can be at least partially absorbed.

SUMMARY

The blood volume, the plasma volume, the red blood cell count, the haemoglobin, the content in chlorides of blood and the content in water of blood and muscle have been determined before and after (1) division of the oesophagus in the neck, (2) food and water deprivation for 80 hours, (3) the graded re-

moval of blood plasma over a period during which the animals were not allowed food and water and (4) the graded removal of whole blood during a period of food and water deprivation.

The alterations which were produced by ligation of the oesophagus and by the removal of plasma were quite similar. The findings suggest that dehydration which is probably due in the main to the loss of saliva is largely responsible for the early death which follows division of the oesophagus.

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TABLE VI—THE PERCENTAGE DECREASE IN BLOOD PLASMA AND BLOOD VOLUME AFTER THE VARIOUS PROCEDURES

| Ty p e | Ex p e r i m e n t | Dur a t i o n | P e r c e n t d e c r e a s e i n p l a s m a | P e r c e n t d e c r e a s e i n b l o o d | P e r c e n t d e c r e a s e i n b l o o d p l a s m a |
|---|--------------------|---------------|---|---|---|
| D i v i s i o n o f o e s o p h a g u s | | | 3 | 7 | |
| | | 8 | 2 | 3 | 75 |
| | | 48 | 3 | | 89 |
| | | 5 | 39 | 7 | 90 |
| | | | 7 | | 6 |
| | | 6 | 3 | 8 | 13 |
| | | | 7 | | 69.8 |
| | | 8 | 7 | 3 | 76.7 |
| W a t e r d i f f u s i o n | A g | | 5 | 9 | 70.5 |
| | | 8 | 0.6 | 3.5 | 3.6 |
| | | 8 | 9 | | 7 |
| | | 8 | 6.3 | 6.3 | 3.8 |
| | | 8 | 8 | | 6 |
| | A | | 6 | 73 | 65 |
| | | 36 | 6.5 | | 6.6 |
| | | 6 | 36.5 | 6.7 | 5 |
| W a t e r d i f f u s i o n i n f o o d | | 3 | 3.7 | 5 | 6 |
| | | 6 | 6 | 7.6 | 7.6 |
| | | 8 | 8 | 9 | 7.6 |
| | | 6 | 5.7 | | 57 |
| | | 7 | 5 | 33 | 67.8 |
| | A g | | 34.06 | 9.7 | 63.6 |
| | | 60 | 9 | 36.3 | |
| | | 60 | 8 | 9.7 | 36.6 |
| W a t e r d i f f u s i o n i n f o o d a n d b l o o d | | 60 | 9.8 | 3 | 6.9 |
| | | 6 | 8.73 | 47.53 | 5.4 |
| | A g | | 9 | 3.7 | 4.7 |
| | | | | | |

there was usually a small increase in the chloride content. The greatest average decrease in the total blood volume was found in the experiments in which whole blood was removed the next in those experiments in which blood plasma was removed and next in order were those in which the œsophagus was divided. The average diminution in the plasma volume was slightly greater in the experiments upon plasma removal than in those on œsophagus ligation while that in the experiments

on the effects of removal of whole blood was slightly less. In the experiments on the effects of division of the œsophagus 80 per cent of the diminution in the total blood volume was due to the loss of plasma in the experiments on plasma removal it was 69 per cent in those on the removal of whole blood it was 49 per cent and in the experiments on food and water deprivation alone it was 65 per cent. The comparative figures for the different types of experiments are given in Table VI.

The division of the cervical œsophagus and the graded removal of blood plasma from dogs deprived of food and water produced results quite similar in character. Both were associated with approximately the same loss in weight, an increase in the red blood cell count and hemoglobin, a slight diminution in the content in water of blood and muscle and approximately the same degree of diminution in the total volume of plasma. The only definite difference was that the reduction in the total blood volume was greater in the experiments on the removal of blood plasma than in those on division of the œsophagus.

These experiments indicate that the cause for the early death after division of the œsophagus is the loss of fluids. The plasma constituted a smaller part of the total blood volume in these experiments than in those in which plasma was removed repeatedly. Wangenstein and Chunn believed that the explanation for the death of dogs with obstruction of the upper part of the intestines was due to the dehydration and loss of chlorides. Haden and Orr (2) in discussing their own results state: "These results indicate that a fatal intoxication ensues after the cardiac end of the stomach or the œsophagus is obstructed. The clinical course is more rapid and the blood changes are more marked than those occurring subsequent to pyloric or high intestinal obstruction. There is a severe toxæmia as evidenced by the high level of the non-protein nitrogen in the blood. It would seem that the toxic agent must have arisen distal to the obstruction. No further evidence for the action of a toxin is given by them except that sodium chloride which they believe to have a detoxifying action was found to prolong the life of dogs after obstruction of the cardiac end of the stomach."

Three animals in which the cardiac end of the stomach had been obstructed were given subcutaneously 40 cubic centimeters per kilogram body weight of one per cent sodium chloride at varying intervals. They state (3) 'The animals survived 3, 36 and 45 days. At autopsy in each the tape had cut through thus re-establishing continuity.' Instead of a detoxifying action it seems more likely that the sodium chloride saved the animals by maintaining the blood volume at a fairly high level until sufficient time had elapsed for the lumen of the cardia to be restored. After this the secretions from the salivary glands were able to pass into the stomach. The fact that the higher the obstruction is made in the intestinal tract the shorter the length of life is strong evidence in favor of dehydration as being the cause of death. Dogs with obstruction of the pylorus of the stomach live longer than those with obstruction of the cardiac end or of the oesophagus because fluids can reach the stomach under the former condition where they can be at least partially absorbed.

SUMMARY

The blood volume, the plasma volume, the red blood cell count, the haemoglobin, the content in chlorides of blood and the content in water of blood and muscle have been determined before and after (1) division of the oesophagus in the neck, (2) food and water deprivation for 80 hours, (3) the graded re-

moval of blood plasma over a period during which the animals were not allowed food and water and (4) the graded removal of whole blood during a period of food and water deprivation.

The alterations which were produced by ligation of the oesophagus and by the removal of plasma were quite similar. The findings suggest that dehydration which is probably due in the main to the loss of saliva is largely responsible for the early death which follows division of the oesophagus.

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CAUSATION OF BACILLUS WELCHII INFECTIONS IN DOGS BY INJECTION OF STERILE LIVER EXTRACTS OR BILE SALTS¹

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IN a recent paper Rewbridge reported that the intraperitoneal injection of sterile bile or even sterile bile salts brought about the prompt invasion of the peritoneal cavity of dogs with the Welch bacillus. Andrews also showed that autolysis of sterile liver in the peritoneum of dogs brought about a similar anaerobic infection that furthermore there were thermostable water soluble substances in dogs livers which were capable themselves of producing the same phenomenon when injected intraperitoneally.

Dragstedt (5) had previously called attention to the rich anaerobic flora of the liver and presented a review of the literature on this subject to which the reader is referred. In his experiments on liver autolysis *in vivo* he found that autoclaved sterile liver underwent sterile slow autolysis in the dog's peritoneum without producing toxic symptoms. However he used large hard masses of cooked liver which naturally presented little surface for autolysis and we found that when the livers were ground with sand they would still produce the toxic syndrome even though sterile and the name autolysis peritonitis was given to the condition (1).

In view of these findings the following experiments were undertaken to attempt to show the source of these infections and their mechanism.

EXPERIMENTAL

The first question to be solved was whether the organisms came from the known rich flora of the liver or if they made their way out of the bowel or if the phenomenon was simply a recrudescence of bacteria in tissues brought about by the presence of tissue poisons which reduced the bactericidal power of the cells.

To ascertain if the nearness of the liver was an important factor in a series of four dogs a tube was inserted into the gall bladder which was inverted as for a cholecystostomy and a watertight joint made. This tube was led in

four dogs into the cul de sac and allowed to drain. In two of these dogs we forgot to ligate the common duct as intended. In all four however there was a prompt death from autolytic peritonitis with a rich Welch bacillus growth. This peritonitis was mainly in the pelvis and lower abdomen at a distance from the liver.

Next a similar experiment was done in two dogs except that the tube was led over the ribs subcutaneously and then into the chest cavity. One dog died of unknown cause 24 hours later having no bile drainage at all but the other had bile in the pleural cavity and a hemorrhagic pleurisy with much exudate and a bacillus welchii infection as demonstrated by obvious gas formation in the tissues and confirmed by culture.

The bile of our laboratory dogs has been shown by Rewbridge to be uniformly sterile but in view of the close association with the known liver flora as well as the finding of other observers of bacteria in normal bile these experiments could not be considered conclusive and therefore they were repeated with material the sterility of which could be more adequately controlled.

Liver extracts were prepared as outlined in a former paper by Andrews. These extracts in the dose given are uniformly capable of producing a fatal autolytic peritonitis if injected into the upper abdomen. The results are given in Table I. It will be seen from these results that proximity of the liver or the intestinal tract is not an important factor. The Welch bacillus infection can occur in the chest or in the muscular tissues just as well although the culture of the injected material in each case showed it to be sterile.

Similar series of experiments with sterile bile salt solutions gave quite comparable results. Two series were run one with 25 cubic centimeters per kilogram and one with 5 cubic centimeters per kilogram. The former series gave some positive results but the latter were

¹ From the Department of Surgery, University of Chicago. This work was done in part during the author's stay at the University of Illinois, Urbana, Illinois.

TABLE I.—EFFECT OF INJECTING AUTOCLAVED LIVER EXTRACT

| I n t r a p e l v i c a l | | | | | |
|---------------------------|---|-----------------|-------------------------------------|-----------------------|---|
| N | M e t h o d | C l i n i c a l | S i g n s | C l i n i c a l | P o s t m o r t e m |
| 06 | W t e x t r a c t f r o m o t o r t r a n s f e r r e d t o m u s c l e | S t e r i l e | 4 h S i g n s o f d e t r i m e n t | N o t d e t e c t e d | N o t d e t e c t e d |
| | S m a s o 6 | S t e r i l e | h | B l a s t | A u t o l y t i c p e r i t o n i t i s |
| I n t r a t h e s t i c | | | | | |
| 37 | S m a s o 6 | S t e r i l e | 5 m | | Shock |
| 6 | S m a s o 6 | S t e r i l e | h | B l a s t | L e g s g a s t r o n g l y s w o l l e n g r a s s o m e m o r t |
| 6 | S m a s o 6 | S t e r i l e | 7 h | N o t d e t e c t e d | N o m u s c l e h e s t |
| I n t r a m u s c u l a r | | | | | |
| 00 | S a m e o 6 | S t e r i l e | 8 h | B l a s t | G a s t r o n g l y s w o l l e n f a t |
| 31 | S a m e o 6 | S t e r i l e | 6 h | B l a s t | C u t t e n f a t |
| 36 | S m a s o 6 | S t e r i l e | 8 h | B l a s t | C u t t e n N o b G l t |

quite uniformly positive (See Tables II, III and IV)

It is clear from the experiments then that the injection of either of these sterile tissue poisons is capable of setting up a bacillus welchii infection locally whether it is injected into the chest, abdomen or muscular tissues and that the proximity of the liver or intestinal tract is not a vital factor in the process. The presence of bacillus welchii in normal muscle is not generally conceded although it has been reported by Reith and certain other clinical phenomenon to be discussed later have a bearing on the problem. Small free transplants of muscle have been used freely as haemostatic agents with no bad results. The following experiments cast some light on this matter. It is well known that the implantation of relatively large amounts of muscle into the peritoneal cavity of dogs is as a rule harmless and does not lead to any septic process. However the use of ground muscle has led to very different results.

Table V shows the results of a set of such experiments. It can be seen that ground sterile muscle produces no infection or toxæmia and undergoes slow autolysis and that it produces no tissue poison capable of bringing about infection. However ground fresh (not autoclaved) muscle when implanted in large amounts brings about a typical autolytic peritonitis. One must assume then that this im-

planted muscle contains small numbers of bacteria which are freed from cells in the process of grinding and are then capable of multiplying very rapidly on the necrotic tissue.

As further evidence on this point the experiments given in Table VI are referred to. Six dogs were given barbitol in doses to last 4 hours. One leg of each was then tied off near the pelvis with hay wire wound as tightly as possible with a pliers. This assured us that no bacteria could make their way into the leg from the circulation. The legs although thus rendered completely separate were left on the animals to insure against the possibility of infection being introduced into the cut surface. Three animals were kept as controls and the three others received injections of liver extract shown by culture to be sterile. All the living animals were sacrificed in 24 hours. The control series of course were all gangrenous but although one of them showed gas bacilli on culture there was no real gas gangrene in any case. The injected series all were enormously swollen and had evident crepitus to palpation. Incision revealed that the muscles and fascia were riddled with gas bubbles and the cultures all showed Welch bacilli. This experiment is considered by the authors to be a crucial one. There is every reason to think that the same number of bacteria were present in each series but in the injected ones only gas gangrene occurred. One

TABLE II—INJECTION OF STERILE BILE SALTS SOLUTION INTO PELVIS

| N | Material | Culture | Survival | Culture type | Postmortem |
|----|--------------------------|---------|----------|--------------|---|
| 9 | 5 m/kl f ev bl salts sol | St l | h | Str ptoc | N f t e e h l f l i pe to m flamm \ry |
| 93 | S m op | St l | hr | Ng t | F t se o-sa guneo som i fl mmati oo da |
| 89 | S m 9 | St l | 8 h | Ng t | F t -sa guneo som fl mm ti s xud t |
| 9 | S m 9 | St l | hr | B w l h | F t e c m h flamm tu 300 cm -sa gu eo xud t |
| 4 | 5 m/kl f ev bl lts l | S l | hrs | B w l h | N f t m se sa gu eo max d fl mma 300 da |
| 5 | Sam as | S l | 8 hrs | B w l h | F t e c os f te light inflamma so |
| | Sam as | St l | 8 hrs | B w l h | F t e c sis light flammati some d t |
| 3 | S m | St l | 4 hrs | B w l h | F t e c dat l ht fla mati so |
| 1 | S m as | St l | 6 h | B w l h | N f m sis m l d flamm oo da |

TABLE III—INJECTION OF STERILE BILE SALTS SOLUTION INTO CHEST

| N | Material | Culture | Survival | Culture type | Postmortem |
|----|--------------------|---------|----------|--------------|---|
| 9 | 5 m/kl f ev bl lts | St l | h | B w l h | B l t l t f l i ga L tle fee fluid |
| 9 | S m 9 | S l | 6 hrs | B w l h | D t mpe b l al gen s em. bloody fluid h |
| 95 | S m as 9 | S l | 6 h | Ng | L ga coll pted es fluid ches |
| 97 | S m 9 | S l | h | Ng | If m rih g solid tu Littl f fluid |

TABLE IV—INJECTION OF STERILE BILE SALTS SOLUTION INTO SUBCUTANEOUS TISSUE

| N | Material | Culture | Survival | Culture type | Postmortem |
|----|------------------------|---------|----------|--------------|----------------------------|
| | 5 m/kl f ev bl lts sol | St l | 4 h | | N i d t f jecti was f d |
| 83 | S m | S l | 8 hr | B w l h | Slight d ti gas b bles iss |
| 9 | S m | St al | hr | | N i d f jec was f d |
| 7 | 5 m/kl f ev bl lts sol | S l | hr | B w l h | G and b ss |
| | S m 7 | St al | 8 h | B w l h | G ss d b es |
| 5 | S m as 7 | S l | 8 h | B w l h | G d ti m ll bsc ss |
| 3 | S m | St l | 4 hr | B w l h | G ti d b ss |
| 15 | S m as | S al | hrs | B w l h | Gas ti and ti bsc ss |

feels justified therefore in assuming that the liver extract acts by destroying in some manner the normal bactericidal power of the tissues so that the rapid multiplication of the organisms is favored.

Bacteriological studies were next made of twelve strains of the Welch bacillus six of which were recovered from peritoneal exudate from autolytic peritonitis in dogs caused by

sterile liver extract and six from that caused by bile draining into the peritoneum. The organisms were first grown on litmus milk media causing stormy fermentation. They were then plated on anaerobic blood agar plates and the grey colonies surrounded by a zone of beta hemolysis chosen. Smears were made showing large gram positive bacilli with spores. From this pure culture tubes of a

TABLE V—EFFECT OF IMPLANTING FRESH GROUND AND AUTOCLAVED MUSCLE INTO PERITONEUM

| N | Material implanted | Culture implant | Survival h | Characteristic | Postmortem |
|-----|--|-----------------|------------|----------------|---------------------------------|
| 20 | 100 gm fresh ground muscle + autoclave | Sterile | 48 h | B. welchii | Welded to viscera, fatal |
| 4 | Same as 20 | B. welchii | 48 h | B. welchii | Injected to 500 cm, no gain |
| 34 | Same as 20 | Sterile | 48 h | B. welchii | Injected to 500-700 cm, no gain |
| 213 | 100 gm fresh ground muscle + autoclave | Sterile | 176 h | Sterile | No multiplicity |
| 9 | Same as 5 | Sterile | 56 h | Sterile | No multiplicity |
| 213 | Same as 25 | Sterile | 176 h | Sterile | No multiplicity |

TABLE VI—EFFECT OF COMPLETE LIGATION OF LIMB WITH AND WITHOUT INJECTION OF LIVER EXTRACT

| N | Material injected | Culture | Survival h | Characteristic | Postmortem |
|-----|---|---------|------------|----------------|------------------------------|
| 3 | Leg with complete ligation + liver extract + 100 gm fresh ground muscle + autoclave | Sterile | 48 h | B. welchii | Legs swollen, fatal |
| 9 | Same as 3 | Sterile | 48 h | B. welchii | Legs swollen, fatal |
| 300 | Same as 3 | Sterile | 18 h | B. welchii | Legs swollen, fatal |
| 89 | Leg with complete ligation + liver extract + 100 gm fresh ground muscle + autoclave | Sterile | 48 h | Negative | Legs slightly swollen, fatal |
| 33 | Same as 89 | Sterile | 48 h | Negative | Legs slightly swollen, fatal |
| 9 | Same as 89 | Sterile | 48 h | B. welchii | Legs slightly swollen, fatal |

series of sugars were inoculated (see Table VII). This included glucose, lactose, raffinose, sucrose, and trehalose. In each case there was fermentation with the production of both acid and gas. In the series of 12 strains this proves beyond a doubt that the organism is the typical Welch bacillus. Tests of the toxicity of Berkefeld filtrates of broth cultures are shown in Table VIII. All the animals died with paralysis as is typical for this organism.

Toxicity tests were made of the peritoneal exudate of dogs dying of autolytic peritonitis. After numerous experiments on mice had been made with negative results after the use of various fractions, a dog was given intravenously the entire centrifuged exudate from another dog which had just died. This totaled 240 cubic centimeters of bloody purulent material. To our utter surprise there was no evidence whatsoever of any toxic effect. This in spite of the fact that the centrifuged material

contained many bacteria still, although the major portion had been thrown down in the centrifuging. The interpretation of these results is difficult but one is led to the conclusion that most of the toxic matter had already been absorbed into the circulation of the dying dog.

DISCUSSION

The provocation of infection in the animal body by sterile material is not a new matter. The power of sulphur to cause abscesses has long been known. The substances used by us in these experiments are, however, physiological fluids which might conceivably be duplicated under clinical conditions. The real point of course is that all tissues have a considerable bacterial flora, and that tissue injury or death may bring about infection of the tissues by bacteria already present. It is likely that the commonest point of entry for bacteria is through the intestinal tract especially

TABLE VII—PERITONEAL EXUDATES OF DOGS WITH BILE DRAINING INTO THE PERITONEAL CAVITY

| N | Milk | Cl se | L to | R ff | S | T h l | Set rs |
|-------------|-----------|-------|-------|-------|-------|-------|------------|
| | Sto m f m | A & G | A & G | A & G | A & G | A & G | G m + b II |
| | S m | A & G | A & G | A & G | A & G | A & G | G m + b II |
| | S m | A & G | A & G | A & G | A & G | A & G | G m + b II |
| 9 | S m | A & G | A & G | A & G | A & G | A & G | G m + b II |
| | S m | A & G | A & G | A & G | A & G | A & C | G m + b II |
| | S m | A & G | A & G | A & C | A & G | A & G | G m + b II |
| C l f h d l | | | | | | | |
| | St m f m | A & G | A & G | A & G | A & G | A & G | G m + b II |
| | S m | A & G | A & G | A & G | A & G | A & G | G m + b II |
| | S m | A & G | A & G | A & C | A & G | A & G | G m + b II |
| | S m | A & G | A & G | A & G | A & C | A & G | G m + b II |
| 5 | S m | A & G | A & G | A & G | A & G | A & G | G m + b II |
| 6 | S m | A & G | A & G | A & G | A & G | A & G | G m + b II |

A—A 1
G—G

in its upper part. The experiments of Arnold in this matter are quite conclusive and they serve to emphasize the enormous number of bacteria which enter the body daily. He found that in most conditions of digestion the duodenal mucosa was impermeable to bacteria but that if the chyme had a hydrogen ion concentration of 8.0 (a quite physiological point) and contained protein (egg white) bacteria injected into duodenum were recovered in the thoracic duct in numbers of 500 to 1,000 per cubic centimeter. These bacteria are of course taken up mostly in the reticulo-endothelial system and destroyed and this is probably the reason that the flora of the liver is so especially rich. Anaerobes and especially spore formers probably survive longer than

other types and are therefore more commonly found in the tissues. It has also been shown by Mueller that the liver is a very important agent in the elimination from the blood stream. There is of course the obvious factor that the blood goes through the liver from the intestines although the lymph from them goes directly into the blood stream.

Many other examples can be cited illustrating what might be called endogenous infection such as seemed to occur in our animals with ligated legs. The fact that gas gangrene occurs not necessarily from deep wounds but in those with lacerated and contused tissues of course is an every day matter for observation. Linton recently and also Eckhoff have reported cases in which gas

TABLE VIII—THE TOXICITY OF BERKFIELD FILTRATES OF 18 HOUR BROTH CULTURES OF BACILLUS WELCHII ADMINISTERED INTRAVENOUSLY TO RABBITS

| Rabbit N | Am ffl | R l |
|----------|--------|------------------|
| N | 5 m | D th w th h rs |
| N | m | D th w th 45 h |
| N 3 | 5 m | D th w th 96 h r |
| N 4 | m | D th w th 8 h |

All animals died

TABLE VIII A—THE TOXICITY OF BERKFIELD FILTRATES OF 18 HOUR BROTH CULTURES OF BACILLUS WELCHII ADMINISTERED INTRAPERITONEALLY

| G | Am ffl | R l |
|------|--------|------------------|
| No | o c m | D th w th 5 h rs |
| N | 5 m | D th w th 48 h |
| No 3 | c m | L g d w ll |
| N 4 | | L ing d w ll |

gangrene occurred without rupture of the skin in gangrenous limbs. Many cases of the same type are in the literature where amputation for gangrene was followed by gas infection. These are of too frequent occurrence to admit of external infection in all cases and must often be due to growth of already present bacteria in the devitalized tissues. This phenomenon is so common that the term "medical gas gangrene" has been coined to apply to the condition.

The prevalence of gas bacillus infection or toxæmia from it has received considerable attention in the clinical literature recently as well as in animal experiments. The Welch bacillus has been blamed for the toxæmia in intestinal obstruction by a considerable number of workers. Appendicitis has yielded such cultures in the hands of many observers. The literature upon these subjects is too large to permit review here but its very magnitude is suggestive of the fact that similar conditions of bacterial growth in normal human tissues take place as well as of those of experimental animals. Davidson recently has even reported observations on the importance of anaerobes in pernicious anemia. Gordon Taylor also reports the finding of Welch bacilli in cases of severe fulminant cholecystitis and gangrenous gall bladders.

These reports of other workers as well as our own experiments serve to call attention to the bacterial content of normal tissues and especially the richness of the anaerobic flora and to emphasize the clinical possibility that local gangrene or severe tissue injury may per-

mit an active infection by organism previously lying dormant.

CONCLUSIONS

1. Septic processes may be initiated in the pelvis, chest or muscular tissues by the injection of sterile bile salt solution, bile or sterile liver extract.

2. The infecting agent is the Welch bacillus.

3. This phenomenon is due to organisms already present locally in tissues which begin to multiply when tissue damage takes place.

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TABLE VII—PERITONIAL EXUDATES OF DOGS WITH BILE DRAINING INTO THE PERITONEAL CAVITY

| N | Milk | Glucose | Lactose | Raffinose | S | Thi | Sm |
|----------|---------|---------|---------|-----------|-------|-------|-------------|
| | S myl m | A & G | A & G | A & G | A & G | A & G | G m + b ll |
| | S m | A & C | A & G | A & G | A & G | A & G | G m + b ll |
| | m | A & G | A & G | A & G | A & G | A & G | G m + b ll |
| | S m | A & G | A & G | A & G | A & G | A & G | G m + b ll |
| 3 | S m | A & G | A & G | A & G | A & G | A & C | G m + b ll |
| | S m | A & G | A & G | A & G | A & G | A & G | G m + b ll |
| Cultures | | | | | | | |
| | S myl m | A & G | A & C | A & C | A & G | A & G | G m + b ll |
| | S m | A & G | A & G | A & G | A & C | A & G | G m + b ll |
| | S m | A & G | A & G | A & C | A & G | A & G | G m + b ll |
| | S m | A & G | A & G | A & G | A & C | A & G | G m + ba ll |
| 5 | S m | A & G | A & G | A & G | A & G | A & G | G m + b ll |
| 6 | S m | A & G | A & O | A & G | A & G | A & G | G m + b ll |

A—Ald
G—G

in its upper part. The experiments of Arnold in this matter are quite conclusive and they serve to emphasize the enormous number of bacteria which enter the body daily. He found that in most conditions of digestion the duodenal mucosa was impermeable to bacteria but that if the chyme had a hydrogen ion concentration of 8.0 (a quite physiological point) and contained protein (egg white) bacteria injected into duodenum were recovered in the thoracic duct in numbers of 500 to 1,000 per cubic centimeter. These bacteria are of course taken up mostly in the reticulo-endothelial system and destroyed and this is probably the reason that the flora of the liver is so especially rich. Anaerobes and especially spore formers probably survive longer than

other types and are therefore more commonly found in the tissues. It has also been shown by Mueller that the liver is a very important agent in the elimination from the blood stream. There is of course the obvious factor that the blood goes through the liver from the intestines although the lymph from them goes directly into the blood stream.

Many other examples can be cited illustrating what might be called endogenous infection such as seemed to occur in our animals with ligated legs. The fact that gas gangrene occurs not necessarily from deep wounds but in those with lacerated and contused tissues of course is an every day matter for observation. Linton recently and also Eckhoff have reported cases in which gas

TABLE VIII—THE TOXICITY OF BERKFIELD FILTRATES OF 18 HOUR BROTH CULTURES OF *BACILLUS WELCHII* ADMINISTERED INTRAPERITONEALLY TO RABBITS

| Rabbit | Amplitude | Result |
|--------|-----------|-------------------|
| N | 5 m | Death within 45 h |
| No | m | Death within 45 h |
| No 3 | 5 cm | Death within 96 h |
| N 4 | m | Death within 8 h |

All animals showed polyuria

TABLE VIIIA—THE TOXICITY OF BERKFIELD FILTRATES OF 18 HOUR BROTH CULTURES OF *BACILLUS WELCHII* ADMINISTERED INTRAPERITONEALLY

| G | Amplitude | Result |
|-----|-----------|-------------------|
| N | cm | Death within 5 h |
| N | 5 m | Death within 48 h |
| N 3 | m | Liver dull |
| N 4 | | Liver dull |

while in only 2 cases was the injury reported to have occurred with the knee forced into hyperextension. One of these latter was a member of this hospital staff and at operation the meniscus was found to be loose but not torn. The other case was that of an intelligent young man of 17 years in whose knee the medial meniscus was found completely detached peripherally rotated 180 degrees and displaced into the intercondyloid space there was also a complete rupture of the anterior crucial ligament.

SYMPTOMATOLOGY

1. *Subjective symptoms*

Pain. Pain was a constant symptom in cases with a definite history of injury. When the reaction from the initial injury had subsided usually in 2 days to 2 weeks pain as well as other symptoms usually disappeared entirely. The patient might have returned to his normal activity with no consciousness of the knee ever having been injured but for a second attack occurring a few days to several weeks later. Except in a few instances pain as well as other symptoms was less in severity in recurrent attacks. Four patients in this series had no pain, two of them complained of stiffness, one of recurrent hydrarthrosis and one a child 5 years old of cracking sounds.

The pain was usually referred to the medial or lateral aspect of the joint corresponding to the side of the injured meniscus. In exceptional cases pain was referred to the opposite side, to the popliteal space to the medial as well as to the lateral side or to the entire anterior surface of the knee joint. Two cases gave definite history of pain located at the time of the initial injury over the medial side of the joint. Local tenderness however when these patients were examined several weeks later was localized over the lateral aspect of the joint. Too much emphasis was attached by one of our staff to the localization of pain at the initial injury the significance of the local tenderness being minimized. In one of these cases the medial meniscus was found to be loose but its removal did not give relief of symptoms. A few months later after removal of the lateral meniscus which

was found to be split longitudinally, all the symptoms subsided. In the other case the medial meniscus was examined first and removed as being abnormally loose. The surgeon was not satisfied with the pathology and the lateral side was explored disclosing a longitudinal split of its meniscus.

One patient with a definite history of pain localized in the popliteal space had both menisci removed at one operation. The medial was abnormally loose the lateral was split longitudinally. Four patients complaining equally of pain over the medial and lateral aspects of the joint were relieved of their symptoms following removal of the medial meniscus. One patient complaining equally of pain over the medial and lateral sides of the joint had both menisci removed the medial being loose the lateral split longitudinally. Three patients complaining of pain over the entire anterior surface of the joint were relieved by removal of the medial meniscus alone.

Swelling. Swelling was next in frequency. It can be stated that with the exception of 14 cases with no definite history of injury swelling was a constant symptom of which patients complained.

Locking. Locking is the inability to extend the knee fully actively or passively. It occurs suddenly and is due to the interposition of some substance between the opposed articular surfaces. In the cases of this series it was due to a loose split and displaced meniscus. Locking may be momentary or may persist until reduced by manipulation. In a few instances when attempts to unlock the knee joint failed these patients were operated upon with the knee in the locked position.

In textbooks locking is considered as the keynote and the most constant symptom in the diagnosis of traumatic lesions of the menisci. In this series it was present in 70 cases 56 per cent which is contrary to the general conception of its frequency. In about two thirds of this number locking was associated with some of the other sensations such as slipping snapping giving way and weakness while in one third it was present alone. In recurrences this symptom is

DERANGEMENT OF THE MENISCI OF THE KNEE JOINT

A REPORT OF AN END RESULT STUDY OF ONE HUNDRED AND FORTY TWO CASES
TREATED BY OPERATIONLEONIDAS A. LANTZOUNIS, M.D., NEW YORK
Fellow of the American Orthopedic Association, 1911, 1914

THIS study is limited to mechanical injuries of the menisci which conditions form the largest part of the group known as internal derangement of the knee joint. One hundred and forty two such knees were operated upon at the New York Orthopedic Dispensary and Hospital between January 1920 and August 1928.

The average time that elapsed from the original injury until the operation was performed was $4\frac{1}{2}$ years. The maximum was 40 years, the minimum 2 weeks. The average time that elapsed from the first visit to the dispensary to the time of operation was $3\frac{1}{2}$ months, the maximum 6 years and the minimum 1 week.

Cases of mechanical injuries of the menisci were more numerous during the latter years of this survey, as follows: 36 cases were operated upon from 1920 to 1924 inclusive, while 108 cases were operated upon from 1925 to August 1928. These operations were done by fourteen surgeons.

Sixty-four per cent of the patients in this series were males. Injuries to the menisci are more frequent during the active period of life, from 16 to 35 years of age. The average age at the time of operation was 8 years. With the exception of one patient 5 years old who had a congenital abnormality of the meniscus, the ages varied from 11 to 62 years.

KNEE AND MENISCUS INVOLVED

Both knees are equally susceptible to injury and there is practically no difference as to the frequency. The right knee in this series was involved in 72 cases, the left in 70.

One hundred and forty-eight menisci were removed from 142 knees of 139 patients. Three patients had the medial meniscus of both knees removed at different times; 2 patients had the medial and lateral menisci removed at different times, and 4 patients

had the medial and lateral menisci removed at the same operation.

The medial meniscus was involved in 129 cases and the lateral in 19, the ratio being one to eight, which is a little higher than in series reported previously by other surgeons. Two-thirds of the lateral meniscus cases were of the right knee.

The onset of symptoms was related in the majority of cases to some kind of injury which varied in severity. In a few instances the patients could not attribute the onset to a definite trauma and could not give the date of the onset of the symptoms. In this series there were 20 such cases. In two-fifths of the series injury occurred while patient was engaged in some athletic sport.

| | Class of injury | No. of |
|----|---|------------|
| 1 | Athletic sports: football, tennis, golf, basketball, etc. | 53 |
| 2 | Fall from height, while on horse, bicycle, etc. | 31 |
| 3 | Striking knee on table, trunk, etc. | 0 |
| 4 | Twisting knee while walking, going to a dance, etc. | 7 |
| 5 | Getting up from kneeling, going to a dance, etc. | 3 |
| 6 | Being dragged, tripping, etc. | 3 |
| 7 | Dancing | 4 |
| 8 | Direct injury by a metal pole | 1 |
| 9 | Indirect injury, e.g., over-exertion, etc. | 5 |
| 10 | No history of injury | 5 |
| | Total | 142 |

The severity of injury does not seem to have any bearing upon the pathological findings. In several instances where the injury and the symptoms were severe enough to impress the patient, we were surprised to find only a loose meniscus while in other cases where injury and symptoms were slight, the meniscus was found to be split and displaced.

Position of knee at the time of injury. A position of flexion is the most favorable one for injuries to the menisci. In this series 65 cases gave definite history of the knee being in flexion when the injury was sustained.

the knee in the semi flexed position. This cardinal sign was present in 117 cases 85 per cent. About 8 per cent of the cases in this series complained of pain in the popliteal space when the leg was moved to the limits of flexion and extension. A survey of the pathological findings of this particular group failed to explain the reason for pain referred to the popliteal region.

Palpation of injured meniscus. Palpation of a displaced meniscus is a rare finding although a thickened synovial membrane or an enlarged infrapatellar fat pad may be mistaken for one. The textbooks state that this sign is present approximately in 5 per cent of cases. In this series however it was found in only 16 per cent and this figure may be exaggerated. The pathological findings in those cases in which clinical palpation of the meniscus was recorded revealed an abnormally loose meniscus and not a torn one.

Slight limitation of extension. Slight limitation of extension is defined as a resistance obtained at the end of passive extension of the joint a sensation suggesting the intervention of an elastic substance between the femoral and tibial articular surfaces. This may be caused either by a slight inward displacement of an abnormally loose but not torn meniscus or by the displacement of a portion of a torn meniscus. An attempt to establish this sign has been made during the past 2 years only and it was found present in 14 cases 10 of which had a torn meniscus and 4 an abnormally loose one.

Atrophy. In the recurrent type and in those cases in which the displaced meniscus interfered with normal joint function atrophy of the lower thigh was present. The vastus medialis was the muscle which suffered most. Sixty per cent of the series showed atrophy of the thigh varying from $\frac{1}{8}$ inch to $2\frac{1}{4}$ inches.

Limitation of motion. An abnormally loose or incompletely reduced torn meniscus may interfere with normal flexion extension or with both. Sixty cases 43 per cent of the series had limitation of motion varying from 5 to 50 degrees.

Creptation. Creptation is usually present in recurrent cases and is attributed to a

thickening of the synovial membrane and arthritic proliferation at the articular margins of the patella and femoral condyles. It may be coarse and grating or be felt as a fine leathery friction. It was present in 37 per cent of the series. Its presence signifies a considerable degree of intra articular change but is of no diagnostic value as far as injury of the meniscus is concerned.

RADIOGRAPHIC FINDINGS

Radiographic examination of knees for traumatic lesions of menisci is of very little positive diagnostic value chiefly because the cartilaginous disc does not throw a shadow. The radiograph is valuable however in excluding other conditions such as loose bodies fracture of the tibial spine or tuberosities osteochondritis dissecans calcified infrapatellar fat pad etc conditions which might simulate the symptoms of a deranged meniscus. In a limited number of cases and especially in those in which peripheral detachment or longitudinal split and displacement of the meniscus had occurred the radiograph was of direct diagnostic value by showing an unbalanced joint space that is thin on one side and wide on the other. This finding was regarded as evidence of a derangement of the meniscus on the thin side. In a very few cases there was definite projection of the capsular shadow at the joint margin on the affected side in an anteroposterior view. This is not positive evidence of derangement of a meniscus as the same projection is sometimes noted in other conditions. Preliminary oxygen injection in the knee joint as advocated by some did not result in any definite diagnostic finding in the few cases in which it was tried.

DIAGNOSIS

Let it be stated here that a positive diagnosis is often impossible and that one is never absolutely sure until the joint has been opened and the actual pathology seen. A definite procedure however should be followed in making a diagnosis of an injured meniscus. An intelligent history of the accident including a thorough description of the direction in which the force was applied or the blow received the position of the knee the immediate

described occasionally as a catching sensation. Locking is here referred to as a subjective symptom because the majority of these patients were seen long after the original injury.

Slipping Slipping is the sensation of something going out of place in the medial or lateral compartment of the joint and in this series it was due to the displacement of the meniscus. Slipping is always referred to the side of the injured meniscus and occurs suddenly. The sensation may be associated with other symptoms or occur alone and in this series it was present in 54 cases 43 per cent. In a few instances in which the initial injury occurred suddenly the patient invariably stated that the knee cap went out of place. In recurrent cases it was described as snapping.

Weakness Weakness is the sensation of insecurity and was not complained of at the time of the original injury. It was a symptom usually met with in the free intervals of recurrent cases and also when the displaced meniscus was not completely reduced after the initial attack. Weakness is apparently due to the relaxation of the capsule and the intrinsic ligaments from the recurrent hyaline cartilage and to the atrophy and loss of tone of the quadriceps muscle. In this series 40 cases 37 per cent complained of weakness. Occasionally this symptom is described as instability of the knee joint a condition which very seldom if ever is present unless there is a rupture of the crucial or collateral ligaments associated with the injury of the meniscus.

Giving way Giving way is an expression quite often used by the patients to define the feeling of insecurity and of slipping in recurrences. When encountered at the original attack the accident was invariably a minor one such as getting up from a cross legged position. It was present in 41 cases 33 per cent.

2. Objective findings

Swelling A change in the contour obliteration of the normal depressions and enlargement of the circumference of the knee joint may be established by inspection palpation and measurement. Swelling may be due

either to an increase of the joint fluid or to a thickening of the intra articular tissues or to both. Swelling usually came on a few hours after the initial injury and was caused by the synovial effusion and extravasated blood. In the intervals between the attacks of recurrent cases swelling was largely due to the thickening of the intra articular tissues. In some instances this physical sign was absent as when the case was seen several weeks after the injury or when the reaction was very slight. In this series 59 per cent showed swelling of these 13 per cent showed an increase of the joint fluid 2 per cent intra articular thickening and 24 per cent both increase of joint fluid and intra articular thickening. When the joint fluid is increased it is evenly distributed throughout the joint cavity and varies from a dram to several ounces in amount. Thickening of the intra articular tissues was also evenly distributed except that in a few cases these changes were more pronounced in the region corresponding to the injury. The degree of intra articular changes may vary from that of congestion and slight thickening of the synovial membrane or ligament to a general fullness and bulging of the lateral patellar spaces. The changes in the intra articular tissues depended upon the treatment given immediately after the injury and whether or not the offending meniscus was completely reduced. The duration of the condition the number of recurrences and the possible complication of an infectious arthritis are also influencing factors.

Pain on motion and tenderness Pain on motion and tenderness over the site of the involved meniscus were the most common signs and undoubtedly the most valuable in the diagnosis of traumatic lesions of meniscus. The area of tenderness usually was well localized and was situated just below the apex of the patella on the affected side and over the anterior part of the joint line corresponding to the anterior third of the injured meniscus and the adjacent margin of the tibial tuberosity. The tenderness was undoubtedly due to the inflammatory reaction of the coronary ligament and synovial membrane and was best detected by examining

Pathological findings of menisci were as follows

| | Menisci |
|---------------------------------|-----------|
| Hypermobile | 54 |
| Longitudinally split | 29 |
| Anterior end detached | 23 |
| Transverse or oblique tear | 14 |
| Partially detached peripherally | 12 |
| Torn at the posterior horn | 7 |
| Ragged fibrillated | 8 |
| Cystic degeneration | 1 |
| | <hr/> 148 |

It is evident that an untorn hypermobile meniscus is a definite entity and that relief of symptoms may be obtained by its removal. In this series, this condition was present in 54 cases 36 per cent.

Other operative findings Thickening of the synovial membrane was present in 65 cases 45 per cent. Arthritic lipping was found in 24 cases 17 per cent. Of these 14 cases were in patients under 30 years of age and it was believed that these changes were incited by the mechanical irritation from the damaged meniscus. Enlargement or fibrosis of the infrapatellar fat pad was present in 57 cases 39 per cent. It is not probable that this latter condition can simulate the clinical signs and symptoms of a damaged meniscus.

Other superimposed pathological conditions were as follows

| | Cases |
|---|-------|
| Loose bodies (non ossified) composed of fibrin synovial tissue or cartilage | 11 |
| Loose bodies ossified | 3 |
| Torn crucial ligament | 5 |
| Subluxation of patella | 4 |
| Fibrillation of articular surface of patella | 4 |
| Osteochondritis dissecans | 2 |
| Cystic degeneration of lateral meniscus | 1 |
| Fracture of medial tibial tuberosity | 2 |

Procedure Every case operated upon in this series had a meniscus excised. The conditions mentioned in the preceding table may simulate the symptoms of an injured meniscus but they are included in this series because the pre-operative symptoms strongly suggested that the meniscus was involved also. Excision of the meniscus may be defined as its removal as far posteriorly as possible including at least the anterior three fourths. Excision of the entire meniscus removal or repair of the torn fragment or repair of the relaxed coronary ligament was not done.

The surgical procedure was as follows

| | Menisci |
|---|-----------|
| Excision of meniscus without any other surgical procedure | 83 |
| Excision of meniscus and fibrotic tabs of the infrapatellar fat pad | 41 |
| Excision of meniscus fibrotic tabs of the infrapatellar fat pad and removal of loose bodies | 8 |
| Excision of meniscus and removal of loose bodies | 6 |
| Excision of meniscus and shaving of the fibrillated articular surface of patella | 4 |
| Excision of meniscus and plication of capsule for subluxating patella | 3 |
| Excision of meniscus and transplantation of tibial tubercle for dislocating patella | 1 |
| Excision of meniscus and repair of anterior crucial ligament | 1 |
| Excision of meniscus and partial synovectomy | 1 |
| | <hr/> 148 |

Hæmarthrosis Extravasation of blood in varying degree occurs in every case after operation. Its presence is demonstrated on the day the sutures are removed unless an earlier inspection has been made in order to explain an abnormal temperature. In this series only 17 cases were recorded as having had considerable hæmarthrosis while in the remainder swelling was recorded as slight or of moderate degree. It is believed that the use of a firm cotton flannel bandage has considerably lessened the frequency and the amount of hæmarthrosis and that early mobilization hastens its absorption. Aspiration or probing is unnecessary.

Postoperative infection There was no post operative infection in the knee joint. There were 0 cases of superficial infection including 5 cases with stitch abscesses all of which healed with free and painless motion in 15 to 20 days.

Postoperative physiotherapy Light massage which was started immediately following the removal of sutures and while the patient was still in the hospital was continued in the physical therapy department from 2 to 6 weeks. With the massage passive and active exercises were also given.

Postoperative convalescence The average period of time until the patient returned to his former occupation was 38 days maximum 3 months minimum 7 days.

Postoperative hypermobility The statement is frequently made in the literature that hypermobility or instability is not unusual

signs and symptoms and the behavior of the knee afterward may give the best clues for the diagnosis. In the chronic cases a detailed history is of more diagnostic importance than the physical signs which in some cases are entirely lacking at the time the examination is made.

TREATMENT

Because of the impossibility of knowing the exact pathological condition immediately following any trauma to the knee joint non-operative treatment was adopted for the acute cases except when there was irreducible locking.

Chronic cases seen during the interval of attacks when the physical examination was practically negative and the history was in conclusive were referred to the gymnasium for exercises and massage. These patients however were kept under close observation for the development of symptoms. The application of apparatus for traumatic lesions of menisci is unnecessary and unwise. Unreduced cartilages as well as recurrent cases call for an early operation. Many cases are neglected thereby injuring the internal structures of the knee joint by a prolonged treatment of braces or plaster casts.

Surgery of the knee joint for the relief of mechanical injuries is making slow progress which in some measure can be attributed to the so called good results secured by conservatism and also to the fear of sepsis and subsequent stiffness. Regarding conservative treatment in this type of case let it be stated that histologists pathologists and research workers have repeatedly failed to demonstrate any regenerative power of the cartilage. In this series careful macroscopic and microscopic examinations of the torn menisci showed no evidence of repair. In some instances however union had occurred by weak scar tissue. Fear of sepsis and stiffness is no doubt founded upon a lack of surgical knowledge and should not be considered during this period of aseptic surgery. In experienced hands this type of surgery is safe and does not require special pre-operative preparation. A tourniquet is used in every case. It is removed after the knee has been firmly bandaged with cotton flannel.

Incision. Previous to 1923 the transverse V shaped oblique and split patella incisions were used but they have been discarded as unsatisfactory. The longitudinal incision which gives a sufficient exposure of the meniscus and also permits a satisfactory view of the joint space has been the routine since 1923. Whenever exploration of both compartments of the joint is called for the bilateral exposure through longitudinal incisions is preferred.

Removal of an innocent looking meniscus when no other abnormality is found to explain the clinical signs and symptoms is advisable. Many cases are recalled in which the supposed offending meniscus upon inspection appeared to be normal yet upon removal a tear at the posterior half or an extensive injury of its tibial surface was found.

Total excision of the meniscus is impossible by any of the incisions mentioned. Approximately the anterior three fourths of the meniscus is removed. This is considered satisfactory as the remaining one fourth has not proved in this series to be a potent cause of recurrent symptoms.

Postoperative mobilization. Passive mobilization is started on the first day after operation and is accomplished with very little discomfort while it lessens the swelling and considerably shortens the convalescent period. Weight bearing is allowed on the sixth day after operation and the patient is discharged from the hospital in 9 to 12 days after operation. Postoperative splinting of the knee has been discarded since 1921.

Surgical pathology of menisci. It is impossible to predict the type of the injury of the meniscus even in those cases in which an intelligent history of the accident is obtained. It has been noted that nothing more than a relaxed meniscus may be found at operation in a case with a history of a severe injury followed by a marked reaction while a meniscus longitudinally split and displaced may be associated with a minor injury and with a slight reaction. The same uncertainty is true as to recurrences. Patients with a severely damaged meniscus may go without any symptoms for several weeks or even months while others with only a relaxed meniscus may be subject to frequent attacks.

PRIMARY SYNOVIAL MEMBRANE TUMORS OF JOINTS

DONALD M. FAULKNER, M.D., RICHMOND, VIRGINIA

PRIMARY synovial membrane tumors of joints are relatively rare neoplasms. Although a case was reported as long ago as 1865 by Langenbeck, Hartman in 1922 in an excellent review of the literature could find only 16 cases to which he added one of his own.

In Hartman's article there were 4 cases reported of pedunculated tumors. All of these occurred in the knee joint; they were all diagnosed as sarcoma, and 3 of them recovered with no note as to the fate of the fourth. Two of these tumors showed giant cells.

The other cases he classified as diffuse tumors with giant cells and diffuse tumors without giant cells. There were 4 of the former and 9 of the latter. In those with giant cells 3 of the patients recovered. In the fourth recurrence of the growth after local excision necessitated thigh amputation, and the gross specimen showed not only local recurrence but several plaques of grayish tissue in the bones about the knee, which may be considered as evidence of metastasis. Three of these tumors were in the knee with the other in the ankle joint.

The diffuse tumors without giant cells are evidently of potentially higher malignancy than either of the other groups. One of these died from metastases, and another showed rapid early metastatic growths, although no record of the final result is given. Eight were diagnosed sarcoma while in the ninth no histopathological diagnosis was made. All of these occurred in the knee joint except one which was found in the ankle.

Since Hartman's article there has been the same paucity of literature on true joint tumors. In 1911 Osgood reported a cavernous angioma of the knee joint on which he had operated and included 3 other similar cases described by Zesas, Reichel, and Oesser, but these were not true synovial membrane tumors.

In 1927 Harbitz of Oslo reported very briefly 10 cases of tumors of the articular capsule and synovial membrane and in more

detail described two diffuse infiltrating tumors of the synovial membrane of the knee. Although he was not specific as to this point we take it that all these specimens were studied at the University of Oslo. Of the first 10 cases it would seem that only one is definitely proved primary synovial membrane tumor. Both of these occurred in the knee joint and both were diagnosed sarcoma. One was pedunculated. The 8 other cases which Harbitz briefly reported occurred in the capsule but apparently were not primary in the synovial membrane. The two diffuse infiltrating tumors he described were primary in the synovial membrane of the knee and had invaded both cartilage and bone. One of these patients died following amputation, while the other had a resection of the joint which evidently was curative. The fatal tumor was a polymorphonuclear cell sarcoma with giant cells and the less malignant though infiltrative growth he classified as a xanthofibrosarcoma.

In a group of four tumors which he called synoviomata and which he considered to be different from any form of neoplasm hitherto described, Smith included one which was primary in the synovial membrane of the knee. It was a rapidly growing malignant neoplasm and death occurred five months after amputation through the thigh.

TALBOT'S CASES

Talbot in 1928 added 3 cases to those already reported but limited his article to those primary synovial membrane tumors containing giant cells. He gave a very complete report of 1 case of his own and almost as full an account of other recent cases in the French literature in addition to giving abstracts of 6 other cases which were quoted in Hartman's article. The bibliography which follows his paper is admirably comprehensive.

Talbot's patient was a man 20 years old who was admitted to the hospital because of swelling and a slight disturbance of function in the ankle. This had followed a fracture of the thigh 4 years before which

following removal of a meniscus but in this series no patient complained of this. However in 4 cases not including those with rupture of the crucial ligaments hypermobility was present after the operation but in the same cases it had been found before operation. The 6 cases in which both menisci were removed showed no hypermobility.

END RESULTS

Of the entire series 8 cases have not been seen since their discharge from the hospital following operation. Because of the fact that there was no individual who was not improved by the operation the results of the remaining 134 cases are classified in two groups: excellent and good.

In the first group there were 114 cases, 85 per cent which included (1) Twenty-two patients who although upon casual inquiry considered the result as excellent and at the end result examination failed to present any objective findings yet upon a closer questioning admitted the existence of subjective symptoms such as fatigue after long standing or walking inability to kneel stiffness on rainy days etc. All these patients have returned to their regular occupations participate in athletics etc. (2) Seven patients who were unable to report for end result examination wrote that they were very much pleased with the operation and considered the result excellent. (3) Twenty patients who could not be traced for the end result examination but who were discharged from the follow up clinic with an excellent result to 4 years after operation.

In the second group there were 20 cases, 15 per cent. These patients were relieved of the major part of their symptoms but at the end result examination presented a few symptoms or objective findings or both. In this group are included 8 patients who could not be traced for the end result examination but when last seen were partially relieved.

It is interesting to note that no patient in the last group presented a typical history of

deranged meniscus. They were patients who were operated upon either to establish the pathological condition after a long period of observation at the clinic or patients with superimposed pathology such as fracture of the tibial tuberosity chronic arthritis with fibrillation of the articular cartilage osteochondritis dissecans etc.

SUMMARY

- 1 One hundred and forty-four operations on 139 patients with derangements of a meniscus are reported.
- 2 The operations were all done between January 1920 and August 1928.
- 3 There were 89 males and 50 females.
- 4 The age at the time of operation varied between 11 and 62 years, the average being 28 years.
- 5 There was no operative death or cases of postoperative infection of the knee joint.
- 6 The average duration of symptoms before operation was 4½ years.
- 7 The results were 85 per cent excellent and 15 per cent good.

CONCLUSIONS

- 1 An untorso hypermobile meniscus is a definite entity.
- 2 A deranged meniscus may occur in an arthritic joint or may be the inciting cause of arthritis on account of the constant mechanical irritation.
- 3 The presence of arthritis in a knee joint complicated by a deranged meniscus does not constitute a contra indication for operation and the symptoms may be greatly relieved by removal of the meniscus.
- 4 Removal of one or both menisci does not result in an unstable knee joint.
- 5 The removal of an offending meniscus by operation is a better procedure than any prolonged conservative method of treatment.
- 6 The relief of symptoms in uncomplicated traumatic lesions of menisci is uniformly complete following removal of the meniscus.

he was walking with a slight limp although the functions of the right knee were not impaired. There was a 1 inch difference in the measurement of the knees with a slight fullness under the right patellar tendon which was slightly tender. He was treated for 4 months for chronic synovitis but as there was no improvement the patella was split and the knee joint explored. Previous to this an X ray film was taken which showed a mass behind the patellar tendon. A solid tumor covered by a synovial veil lay in the knee joint. It was attached to the outer anterior inferior border of the capsule by a small attachment. It measured 7 centimeters by 5 centimeters by 3 centimeters and was surrounded by a definite capsule. Under the microscope the tumor showed peculiar elongated blunt cells sometimes fusiform in shape lying closely together. The nuclei were round and oval in shape. In certain zones the fibrous tissue seemed to exceed the cellular elements. Numerous mitotic figures were noted and one would think one was dealing with an atypical sarcomatous growth. As to color the tumor had a yellow and brownish tinge resembling the color of synovial membrane. It was resistant as in kidney tissue therefore very cellular. On cut surface the increased pigment was shown near the center in small islets.

After 1 year there was a recurrence of the growth on the outer side of the knee treated by an extensive capsular resection. A year later in spite of treatment with X rays and Coley's toxin there was an other recurrence which invaded the upper end of the tibia and a mid thigh amputation was done. He has now been well for 4 years.

Wagner's second case was a girl 15 years old who had complained of pain and swelling on the front of the right ankle for 6 years. Examination was negative except for a semi solid movable tumor on the front of the right ankle under the tendons on the dorsum of the ankle. X rays showed a definite soft tissue mass anterior to the ankle joint. An arthrotomy exposed a tumor 6 centimeters by 3 centimeters by 2 centimeters attached to the synovial membrane of the ankle joint. It was similar grossly and microscopically to the other tumor he describes except that it showed no mitotic figures. The girl has remained well for 1 year although when last seen she complained of a little pain which Wagner says usually precedes the appearance of the tumor. Therefore he suspects a recurrence.

AUTHOR'S CASES

The writer's interest in this subject has been stimulated by a recent case in a young woman operated upon by him and his associate Dr William Tate Graham. This is the second case of primary synovial membrane tumor we have operated upon in the past 6 years during which period the number of cases available for examination has been large. Both cases are reported here in detail.

CASE 1 Miss E. C. B. aged 49 years was seen May 10 1924 complaining of a growth in the left knee. She was worried about it because her mother had died of cancer of the breast and she herself had undergone a radical operation for carcinoma of the right breast in 1914. There had been no recurrence. For several years she had noticed a tendency of the left knee to lock and at times this threw her rather severely. For the past 2 or 3 years she had been able to palpate a small freely movable soft mass just above the knee cap located rather deep. She had slight pains at times and recently had had two or three bad falls when the knee gave away under her.

The general examination was negative except that the right breast had been removed by the radical operation and there was a small scar over the inner lower quadrant of the left breast. The left knee showed a small firm somewhat movable mass about the size of a pea located just above and to the outer side of the patella apparently beneath the quadriceps tendon. It was not tender. There was no effusion in the joint and joint motion was free. The skin over the mass appeared normal. There was no atrophy of the extremity and no adenopathy. The X ray examination was negative. A diagnosis of joint mouse or loose body in the knee joint was made and the patient was operated upon May 15 1924 (Drs. Graham and Faulkner). A 5 inch vertical incision was made over the lateral surface of the left knee joint just external to the patella. When the joint was opened and the knee was flexed a dull yellowish tumor about 4 by 6 by 2 centimeters which was fairly vascular came into view. It was attached by a short pedicle to the synovial membrane about 1 inch below its anterior attachment to the external condyle of the femur. The pedicle was clamped and cut and the tumor excised. There was some oozing from the stump of the pedicle easily controlled by a ligature. The joint was closed in layers and a pillow splint applied.

The pathological report (Dr S. W. Budd) was:

The section is composed of fibrous tissue a large amount of blood pigment numerous giant cells and very active cells of mesodermic origin that make the growth assume some of the characteristics of a sarcoma. Yet a careful microscopic study lead one to believe that these cells while active are not vegetative or malignant in character. The active mesothelial cells with the giant cells and pigment are collected in lobules separated by wide strands of fibrous tissue. The whole structure is very vascular. This is particularly noticeable in the fibrous tissue separating the lobules although blood vessels of considerable size are present in the lobules. In the lobules where the cells take on sarcomatous appearance there are numerous large macrophages filled with pigment. Here and there one sees a typical foam cell.

The question as to diagnosis of this tissue is intricate. The activity is not enough to warrant the diagnosis of a sarcoma and for all purposes a sarcomatous growth more nearly sums up the condition we have just described. (Figs 1 and 2)

had been treated by traction on the ankle for 60 days. On examination the left ankle was found to be swollen. There was a protruding mass in front of the ankle on either side which partially disappeared on plantar flexion and increased on dorsiflexion of the foot. These swellings were flabby and pseudo-fluctuant but the lateral mass was smooth firm movable somewhat like a loose body in the joint. No pedicle was felt. The general physical examination revealed nothing abnormal and an x-ray of the ankle was negative. At operation a tumor was found in the ankle joint attached by a pedicle to the deep surface of the articular synovia. It was excised with the synovia at the base of the pedicle and the joint was closed in layers. He noted especially that there was no connection between the tumor and the adjacent tendon sheaths. The tumor measured 5 centimeters long by 3 centimeters wide by 2 centimeters in thickness. It was lobulated and pedunculated. The color varied from yellowish saffron to ochre and the consistency was hard at the level of the pedicle but soft toward the free pole. Microscopic examination showed large numbers of giant cells surrounded by fusiform cells areas of pigmentation as from old hemorrhages large cells containing pigment and polyhedral cells with a central nucleus and vacuolar cytoplasm. These last cells resembled the fat cells found about synovial membranes. The whole tumor was surrounded by a layer of fibrous tissue covered over by serous endothelium. There was no cellular evidence of malignancy. The diagnosis was a giant cell tumor primary in the synovial membrane of the ankle (myeloplaxoma).

Talbot quoted fully also a case reported by Abadie d'Oran in 1928.

A woman 45 years old for several months had had a small flat painless tumor on the outer side of the right knee a little behind the patella and in front of the external lateral ligament. At operation it was found attached to the synovial membrane and in order to remove it a square centimeter of synovia had to be excised with it. The microscopic examination showed it to be composed of diverse types of cells with typical lymphocytes predominating but there were also plasma cells macrophages and giant cells. No lipoid cells as such were mentioned but large lymphocytes with a clear nucleus were present.

A third case in Talbot's review is that reported by Paitre and Bruas in 1923.

A soldier who had had a slight fall on the left knee a year before had noticed a little swelling develop in the knee. Only for a few days previous to their examination had he complained of a slight discomfort and abnormal fatigue. When examined the knee was slightly swollen. In the lower part of the joint there was noticed a little protuberance which bulged out the length of the external border of the patellar ligament. This swelling was increased on flexion of the knee and it was fixed by contraction of

the quadriceps. On palpation a mass the size of an apricot seed hard as cartilage could be felt under the patella ligament and apparently attached to it. This mass could be moved laterally with the ligament but not vertically. It was not attached to the bone. Another small mass the size of a pea could be felt near the tibial insertion of the ligament but not seeming to be a part of it. There was fine crepitation on motion of the knee with flexion limited to a right angle by pain. The physical examination was otherwise negative as was radiographic examination of the knee. At operation the joint was opened through an external parapatellar incision. A tumor as large as a small tangerine was found implanted in the fat pad in the intercondylar notch. It was pedunculated. When this was excised six or seven little verrucosities the size of small peas were found in the depths of the intercondylar notch in the notch resulting from the enucleation of the tumor. These suggested an arborescent loma but the consistency was that of a fibroma. The joint was closed and the patient was discharged in 3 weeks. The histological examination showed it to be a tumor which was not homogeneous or encapsulated composed of much dense fibrous tissue with many fibroblasts but with no cells showing abnormal mitoses. Giant cells were found in small numbers and only in certain portions of the growth. The diagnosis was fibrosarcoma with giant cells—histologically a benign tumor.

WAGNER'S CASES

In 1930 L. C. Wagner added cases from the files of the late Dr. Virgil P. Gibney and himself. He states that these are the only 2 tumors of this type found in a study of 467 explorations of the major joints of the body extending from the year 1900 to 1930. He calls both of his neoplasms intra-articular endothelial tumors and in the discussion of his cases Ewing says: "I should think that the diagnosis of fibro-endothelioma was correct."

I would not venture to make a diagnosis on the lantern slides alone if I had not seen in the past 3 months 3 cases very similar to these from Dr. Bloodgood and from Dr. Smith of Harvard and another of our own. The position of the tumor is strongly suggestive of an origin from the endothelial cells lining the bursa. There is no doubt that the bursal endothelioma is capable of extensive proliferation producing tumors of this same general character.

In his first case a man 35 years old without any apparent cause began to complain about 10 years before he saw him of pain in the right knee. Examination showed him to be in good condition but

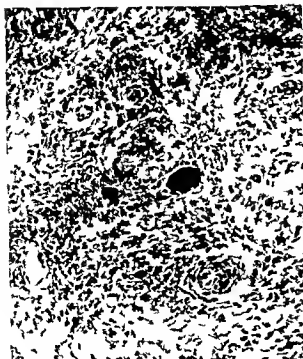


Fig 1 Case 1



Fig 2 Case 1

joint or is it because it is subjected to constant stress and strain and its synovia liable to slight but continuous irritation or even injury?

In those tumors with giant cells it may be surmised that there is an irritative factor. The presence of dense fibrous tissue of cells containing phagocytized blood pigment and of giant cells somewhat of the foreign body type may be taken as some evidence that the origin of the tumor was from chronic irritation and inflammatory reaction. But this is not true of the other types and of course all these elements may be found in true neoplasms.

Perhaps some of the tumors are not true neoplasms but an inflammatory reaction of the synovial membrane. On the other hand 3 of the cases reported resulted in death from metastases and there are records of 5 patients with local recurrence or metastasis.

PATHOLOGY

In a microscopic study of these tumors there is one group which presents a very constant and characteristic picture. This is the tumor which Talbot and other French observers call *tumeur a myeloplaxes* or *myeloplaxoma* of the synovial membrane. Ten such tumors are found in this series of cases. Talbot's description of them is very

accurate and may be summarized here. The structure is polymorphous but the elements which make up the tumor are the same in every case. Essentially these tumors are made up of dense inflammatory connective tissue in the midst of which are three typical findings: first the giant cells which are somewhere between the giant cell of bone and that of the tubercle; second the lipoidal or xanthoma cell; and third the blood pigment found in and about the macrophagocytes. There are no atypical mitotic figures and no embryonic cells. There is no histological evidence of malignancy in these tumors.



Fig 3 Case 2

Following the operation a series of high voltage X-ray treatments were administered by Dr A. L. Gray. The patient made an uneventful recovery and has remained well for six years.

CASE 2 Miss J. A. M. white female aged 8 years was seen May 10, 1930 complaining of severe pain and swelling in the left knee. One year ago while in New York, during an elevated train she felt something slip to the outer side of her left knee cap. Following this the knee became quite painful and swollen and some time later was discolored. The pain persisted and on her return home she saw her physician who had the knee X-rayed. The radiograph failed to show anything abnormal. Several times since this she has felt something slip in her knee and pain and swelling has followed. On one occasion her mother felt something like cartilage in the hollow just below the knee cap on the outside. She pushed this back and it disappeared. Sometimes the knee would become momentarily locked in flexion but after a minute or two something would slip back into place in it and she could straighten it. She thought she might have injured the knee twelve by slight fall but she could not remember any relationship between these and the slipping in the joint.

The past history as unimportant. She had influenza in 1918 an appendectomy in 1915 and an incision of an abscess in the neck during infancy.

Physical examination showed a well developed and well nourished young woman with no significant findings except in the left knee. The knee joint was distended by effusion. There was tenderness especially marked along the joint line anteriorly. To the inner side of the lower medial angle of the patella was felt a smooth ovoid fairly firm body apparently within the joint which moved under the palpating finger. This movement caused acute pain. The movable body seemed about centimeters in diameter. No other mass was felt. There was motion in the joint from 170 to 120 degrees. No inguinal adenopathy was noted. The Wassermann was negative and blood and urine findings were normal.

A roentgen ray examination by Dr J. L. Tabb showed no bone lesions, no evidence of a joint mouse and the joint space appeared normal.

A provisional diagnosis of loose body in the knee joint was made and a patella splitting arthrotomy was done May 9, 1930 (Drs. Graham and Faulkner). On opening the knee several ounces of serous sanguineous mucinous fluid escaped together with several gelatinous clots. The synovial was injected. Attached to the anterior synovial by a pedicle about 1 inch above the internal tuberosity of the tibia was a three lobed tumor $3/4$ by 1 by $1/2$ inches in size. It resembled in shape and color an yolk of egg long out of its shell. This was movable on its pedicle and lay in the compartment of the joint between the femur and the tibia. No fibrous bands or other tumor masses were found. The cartilages and the ligaments were in normal appearance. The tumor

was removed by dividing its pedicle flush with the synovial but not excising the synovial membrane base. The incision was closed in the usual manner.

The pathologist Dr Charles Phillips reported on the tumor as follows: The gross specimen is a smooth somewhat lobulated gray red and yellow moderately firm irregular ovoid mass $6/8$ by $3/4$ by $1/2$ centimeter. It is bent upon itself with its edges partly adherent to form a structure somewhat resembling the finger of a glove. The mass was attached by a pedicle to the synovial membrane.

Microscopically it is a connective tissue neoplasm bearing a superficial resemblance to granulation tissue. Much of its substance is necrotic probably due to constriction of the pedicle with consequent nutritional interference. The cell type is inconstant. Fibroblasts foamy polyhedral cells of the xanthoma type and a few giant cells are seen. There is much phagocytized blood pigment which reacts positively for iron. The histological structure does not suggest a high degree of malignancy.

Pathological diagnosis: Mixed cell sarcoma of synovial membrane (Figs 3, 4 and 5).

The patient had an uneventful convalescence and was walking at the end of the fourth postoperative week. Eight weeks after operation there were more than 90 degrees motion in the knee no fluid or pain but some tenderness and thickening just to the outer side of the latero-inferior angle of the patella. She was referred to Dr. Tabb for postoperative roentgen ray therapy. At the present time (4 months after operation) there are 120 degrees motion in the knee occasional slight pain but no evidence of recurrence and she walks and swims as she wishes.

CLASSIFICATION

Hartman classified primary synovial membrane tumors under three heads: (1) pedunculated tumors (2) diffuse tumors with giant cells (3) diffuse tumors without giant cells. This is a good working classification but it seems to us a simpler and just as serviceable a division would be into those with and those without giant cells. Certainly those with giant cells the myeloplaxoma of the French as a rule give a characteristic microscopic picture while the tumors without giant cells are of diverse types.

ETIOLOGY

As with most neoplasms the etiology can only be guessed at. The predilection of primary synovial membrane tumors for the knee is remarkable. Of the 29 cases reported including both of the authors 5 were found in the knee joint. Is this because the knee is more frequently explored than any other



FIG 1 Case 1



FIG 2 Case 1

joint or is it because it is subjected to constant stress and strain and its synovia liable to slight but continuous irritation or even injury?

In those tumors with giant cells it may be surmised that there is an irritative factor. The presence of dense fibrous tissue of cells containing phagocytized blood pigment and of giant cells somewhat of the foreign body type may be taken as some evidence that the origin of the tumor was from chronic irritation and inflammatory reaction. But this is not true of the other types and of course all these elements may be found in true neoplasms.

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FIG 3 Case 2



F 4 Case 2

F 5 Case 2

Both of our tumors are of this type as are all of Talbot's. Although they are usually not malignant the prognosis must be guarded as two of Hartman's series had local recurrences and one of Harbitz's with giant cells died. All 3 were diffuse.

The synovial membrane tumors without giant cells are of rather diverse pathology. Except for the synoviomata described by Smith and the endotheliomata reported by Wagner they are all described as sarcoma of different types: spindle celled, round celled, large celled sarcoma, vascular fibrosarcoma, and myeloid sarcoma. The synoviomata resulted in an early death as did one of the sarcomata, while the vascular fibrosarcoma and one of the endotheliomata recurred and invaded the neighboring bone. These tumors without giant cells seem to be potentially more malignant.

DIAGNOSIS

The diagnosis of primary synovial membrane tumor is rarely made before operation. Usually the pre-operative diagnosis is a loose body in the joint, a tuberculous arthritis, or a villous arthritis. As a rule a mass can be felt in the joint but if pedunculated it is easily movable and it is thought to be a loose body. The history is never definite. Sometimes as in one of our patients there is severe pain in other cases the pain is negligible and there is merely a little discomfort and slight disability. There is no special age preference and the cases are about equally distributed as to sex. All of those reported have been in the knee and

in the ankle predominantly in the former joint but as the knee is a favorite joint for loose bodies and for various forms of arthritis the site scarcely aids one in making a diagnosis. Probably X-ray examination of the joint after air injection would be helpful but the correct diagnosis usually awaits the surgeon's knife.

PROGNOSIS

The prognosis is generally good both for life and for preservation of the limb. There have been three deaths due to the tumor itself and one other because of operative infection. In this case an autopsy showed no local or remote metastases. Four thigh amputations were done. Thus in 9 patients with true primary synovial membrane tumors there has been a mortality of about 14 per cent, a loss of limb in 14 per cent, and cure as far as is known in 7 per cent. In the 21 cured cases 16 retained function of the joint and 5 of the joints were resected. On the whole this is an excellent record and seems to show that there is more than a 50 per cent chance of retaining joint function after a relatively early operation for primary synovial membrane tumor. After the microscopic examination has been made the prognosis is a little more certain. If the tumor contains giant cells there is approximately a 90 per cent chance for life and a 75 per cent chance for retaining joint function. Yet the prognosis should always be guarded first because a primary synovial membrane tumor with giant cells has been known to cause death or to

recur and second a supposedly primary synovial membrane tumor may be secondary to a hidden osseous tumor yet show lack of clinical evidence of malignancy

TREATMENT

Treatment must be directed to (a) preservation of life (b) saving of limb and (c) retention of joint function

In every case it is wise at operation to have a frozen section examination by a competent pathologist Due to the scarcity of material few pathologists are familiar enough with the histology of these tumors to render an exact opinion as to the degree of malignancy of the growth but in both of our cases the pathologists have strengthened our decision to do a conservative operation by stating that the histological picture did not suggest a high grade of malignancy

In any synovial membrane tumor there is a possibility of malignancy which may result in death But this chance is small enough to justify one in conservative surgery especially so since if the tumor be highly malignant amputation offers little hope of cure

In those cases in which a single pedunculated tumor is found early excision of the tumor with its pedicle and preferably with resection of the small synovial base of the pedicle will usually result in saving life and limb and in the return of joint function Certainly here it is wise to be conservative

In the diffuse tumors whether or not pedunculated synovectomy partial or complete depending on the extent of the synovial involvement would seem to be the best treatment If there is infiltration and partial destruction of the ligaments and cartilage so that the joint structures seem badly damaged one would feel inclined to do a joint resection and arthrodesis

Talbot makes an interesting suggestion in regard to those diffuse tumors with giant cells where it is difficult and mutilating to remove all the growth Recalling the radiosensitivity of giant cell tumors of bones he says it would appear justifiable to try radiotherapy before proceeding to an extensive synovectomy or a joint resection with the consequent loss of joint function We believe operation should

always be followed by a course of radiotherapy but we feel more secure with surgery as the primary treatment for in addition to ridding the patient of the growth it permits a thorough pathological examination

If after the conservative operation there is recurrence of the tumor with invasion of tissue other than the synovia high amputation should be performed at once

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Fig 4 C 2

Fig 5 C

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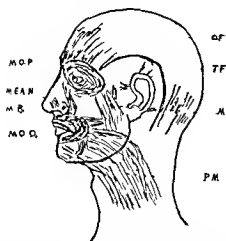


Fig. 1 Muscles of the face and scalp. OF Occipitalis frontalis TF temporal fascia IF masseter PM platysma myoides MOP orbicularis palpebrarum MEAN elevator alae nasi MR risorius MOO orbicularis oris

- (3) inferior to the external auditory meatus
(4) angular alae nasi and (5) malar prominence

The skin of the face varies tremendously in thickness being thinnest over the eyelids and thickest over the point of the chin. In the dissecting room it is not uncommon to find hair follicles within 3 millimeters of the periosteum of the mandible

FACTORS INCREASING THE MALIGNANCY IN INDIVIDUAL LOCATIONS

For the purpose of this discussion we will group those locations of greatest malignancy according to the underlying anatomical factor

- Group 1 underlying bone—
Internal canthus
Malar prominence
Group 2 underlying fascia—
Below the external auditory meatus
Over the temporal region
Group 3 underlying dense integumentum—
Angular alae nasi
Forehead and scalp
Group 4 underlying cartilage—
Skin of nose
Lower eyelid Tarsal plate

There are certain fixed points which determine the physical appearance of the face if there were not we would not be able to recognize our friends who become obese. A few points need be mentioned the symphysis men-

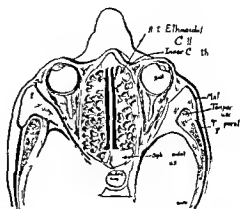


Fig. 2 Horizontal cross section at the level of the inner canthus. Note proximity of ethmoidal cells to inner canthus. Also proximity of temporal fascia to skin

tis the internal canthus the malar prominence and a line joining it and the root of the zygoma. It would seem from this observation that either areolar tissue is lacking in these locations or that fibrous bands unite the integument and the bone. The last we believe to be the correct explanation.

Carcinomata occurring in these situations possess several common characteristics (1) they are erosive (truly rodent) (2) they are usually hasocellular (50 per cent 7) (3) they run a protracted course (4) but are truly malignant—eventually causing death if untreated and (5) they heal superficially under apparently adequate treatment only to recur viciously.

Handley's method of direct extension applies peculiarly to this group of carcinomata.

Group 1 (a) the inner canthus. The skin is very thin in this region and the platysma muscle—the orbicularis palpebrarum—lies quite closely. We also have the tensor tarsi muscle with its ligamentous insertion into the inner wall of the orbit. This inner orbital wall is also the outer wall of the anterior ethmoidal cells (Fig. 2).

The short distance of 3 millimeters lies between the skin of the inner canthus and the ethmoidal cells. Having gained access to the ethmoidal cells cure of carcinoma in this region is improbable. Exenteration of the orbital contents and of the ethmoidal cells *in toto* offers the only hope. Patients at this stage of the disease hesitate to sacrifice the eye. For this they may not be censured. Radiological treatment may prolong life indefinitely — 10

ANATOMICAL FACTORS INFLUENCING MALIGNANCY OF THE SKIN OF THE FACE

PAUL O SNOKE M D LANCASTER PENNSYLVANIA
F m b N y D p a t r i f h L a c a G 11100 p 1

IN almost all of the recent literature on malignancy great stress has been laid upon the histopathological picture the index of malignancy and cell type. The writings of Broders Maltzoff and Norris describing the grading of carcinoma on the basis of cellular differentiation have claimed the radiologists undivided attention. Broders originally began his work as a classification for surgical prognosis but the radiologists were not slow to relate the phenomenon of radiosensitivity to embryonal cellular structure and joyfully find an explanation for hitherto inexplicable radiation responses.

We feel that too much emphasis is being laid upon the histopathological grading of carcinoma and that not enough is being laid upon other very important factors. It is our purpose to show the importance of the anatomical factors in carcinoma of the skin of the face which factors to our minds are as important as the histopathological grading in the prognosis.

Throughout the literature we find statements like this: "The grading of these carcinomata is very important from the standpoint of prognosis and treatment." (4) But deep study of the article fails to reveal any difference in treatment accorded Grade 1 or Grade 4 Broders. Obviously we have been following a fashion. However I would point to Qumby's latest work (8) in which a real difference is made in the treatment of these two grades of malignancy on a reasonable scientific basis.

A more hopeful sign however is found in the work of Lee who has produced a clinical index of malignancy for carcinoma of the breast. A clinical index of this nature tends to evaluate the various factors entering into the prognosis without undue emphasis upon any one. It is a common observation among radiologists that in women with carcinoma of the cervix the thin do well the fat not very

well. Any prognosis must properly evaluate all the factors.

After observing malignancies upon the skin of the face for a number of years it has become quite apparent that in certain locations malignancies are more refractory to treatment recurrences are more common and have more often pursued a course independent of their cell type than have malignancies affecting other parts of the body.

After considerable study one factor of great importance in carcinoma of the skin of the face has seemed to be the anatomical one.

GENERAL ANATOMICAL CONSIDERATIONS

The skin of the face and its subjacent fascia are intimately connected forming the largest sheet of platysma type integument to be found in the body. The muscles of expression are found in the superficial fascia take their origin from fascia except in a very few instances and always insert into fascia. The motor innervation is through the seventh nerve sensory fibers arise from the fifth.

The mobility of the occipitofrontalis muscle and its fascia is proverbial the same mobility holds true for the superficial structures of the face. The most important facial muscles for our purposes are the orbicularis oris the orbicularis palpebrarum and the risorius (Fig 1). The two latter are of importance because they insert into bone.

At the internal canthus we find the closest association between the skin and the underlying structures and it is here that the orbicularis palpebrarum inserts into bone. The risorius takes its origin from the canine fossa connecting the superficial structures with the bone at this point. If we test the mobility of the skin and integument with the finger tip we find five points at which the skin is very close to underlying bone or almost immobile on underlying bone. We enumerate (1) internal canthus (2) symphysis mentis

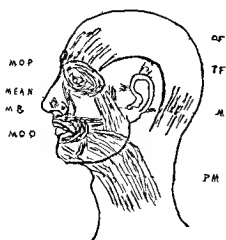


Fig. 1 Muscles of the face and scalp OF occipitalis frontalis TF temporal fascia M masseter PM platysma myodes MOP orbicularis palpebrarum ME elevator alae nasi MR risorius MOO orbicularis oris

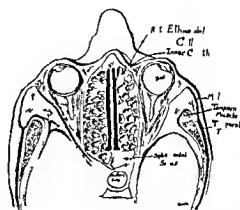


Fig. 2 Horizontal cross section at the level of the inner canthus Note proximity of ethmoidal cells to inner canthus Also proximity of temporal fascia to skin

- (3) inferior to the external auditory meatus (4) angulae alae nasi and (5) malar prominence

The skin of the face varies tremendously in thickness being thinnest over the eyelids and thickest over the point of the chin. In the dissecting room it is not uncommon to find hair follicles within 3 millimeters of the periosteum of the mandible.

FACTORS INCREASING THE MALIGNANCY IN INDIVIDUAL LOCATIONS

For the purpose of this discussion we will group those locations of greatest malignancy according to the underlying anatomical factor

- Group 1 underlying bone—
 - Internal canthus
 - Malar prominence
- Group 2 underlying fascia—
 - Below the external auditory meatus
 - Over the temporal region
- Group 3 underlying dense integumentum—
 - Angulae alae nasi
 - Forehead and scalp
- Group 4 underlying cartilage—
 - Skin of nose
 - Lower eyelid Tarsal plate

There are certain fixed points which determine the physical appearance of the face if there were not we would not be able to recognize our friends who become obese. A few points need be mentioned the symphysis men-

tis the internal canthus the malar prominence and a line joining it and the root of the zygoma. It would seem from this observation that either areolar tissue is lacking in these locations or that fibrous bands unite the integument and the bone. The last we believe to be the correct explanation.

Carcinomata occurring in these situations possess several common characteristics (1) they are erosive (truly rodent) (2) they are usually basocellular (50 per cent) (3) they run a protracted course (4) but are truly malignant—eventually causing death if untreated and (5) they heal superficially under apparently adequate treatment only to recur viciously.

Handley's method of direct extension applies peculiarly to this group of carcinomata.

Group 1 (a) the inner canthus. The skin is very thin in this region and the platysma muscle—the orbicularis palpebrarum—lies quite closely. We also have the tensor tarsi muscle with its ligamentous insertion into the inner wall of the orbit. This inner orbital wall is also the outer wall of the anterior ethmoidal cells (Fig. 2).

The short distance of 3 millimeters lies between the skin of the inner canthus and the ethmoidal cells. Having gained access to the ethmoidal cells cure of carcinoma in this region is improbable. Exenteration of the orbital contents and of the ethmoidal cells in toto offers the only hope. Patients at this stage of the disease hesitate to sacrifice the eye. For this they may not be censured. Radiological treatment may prolong life indefinitely — 10

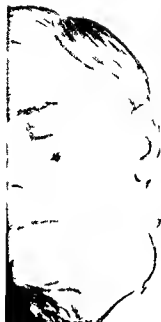


Fig 3



Fig 4



Fig 5

Fig 3 Carcinoma of the parotid gland
 Fig 4 Basal cell carcinoma of the face
 Fig 5 Subcutaneous abscess of the face

years for example—without seriously interrupting the patient's occupation.

X-ray and radium therapy are usually the treatment of choice. Electrocoagulation is valuable especially in any exenteration of ethmoidal cells. The most neglected avenue of approach is through the nose by placing the radium in the superior meatus.

Group 1 (b) the malar prominence. The bony structures are not as superficial here as at the inner canthus, but this is one of the fixed points of facial contour; for beneath this point the fascia of the parotid—the masseter and the temporal fascia—attach themselves to the bone (Fig. 3).

At this point the subcutaneous structures are few and so any infiltrating lesion can rapidly extend directly into the upper outer border of the malar. Sante comments on this fact (Fig. 3).

Group 2 underlying fascia (a) Below the external auditory meatus. The skin of the neck, just below the lobe of the ear is very thin and delicate as attested by its frequency as a site of chronic eczema. Only the thinnest of superficial fascias separates the skin from the fascia of the parotid gland.

This narrow concealed cleft is a center for the union of the parotid fascia, the fascia of

the neck, and the deep fascia of the mandible. In close proximity is the very superficial masseter process. Most important of the subjacent structures is the seventh nerve, also the auricular artery and vein and the temporal artery and vein, while more deeply are the internal carotid artery, the internal jugular vein and the vagus and phrenic nerves. A more dangerous operative site could not be imagined.

Strangely enough carcinomata originating in this region involve the deeper structures but rarely erode them.

The parotid fascia constitutes the Thermopyle of this region. Once penetrated by carcinomatous cells, cure is improbable. An extension of the parotid gland lies here and this affords a field for further growth while surface healing may occur. Trismus occurs transiently at first, later permanently, subsequently the seventh nerve is involved and complete paralysis of the lower branches follows transient attacks.

Operative interference is impossible. Early cytotoxic radiation alone affords hope for cure. The course may extend over a period of 11 years (Fig. 4) with periods of healing and recurrence.

Group (b) carcinoma of the temporal region. Subjacent to the skin in this region lies the temporal fascia. This is thick and fan shaped



Fig 6

Fig 6 Basocellular carcinoma of midline of forehead



Fig 7

Fig 7 Basocellular carcinoma of perichondrium of nose



Fig 8

Fig 8 Basocellular carcinoma involving the lower eyelid

fascia and covers the temporal muscle is inserted in the zygoma inferiorly and superiorly into the temporal ridge (Fig 1). We also find the temporal artery and vein quite superficially in this region.

Early adequate treatment usually cures these carcinomata. The temporal region is a favorite site for senile keratosis and great care must be exercised in their treatment especially if any tendency to infiltration or erosion the result of malignant change is evident (Fig 4). Infiltration and perforation of the temporal fascia again produces a wellnigh hopeless situation. Early lesions in this region should be electrocoagulated down to the fascia the fascia exposed and curetted clean. If this were always done recurrence would be avoided except when the patient appears too late for treatment. Malignant fascial involvement spells disaster.

The course of the disease is fraught with frequent severe hemorrhages from the upper and lower ends of the eroded temporal artery and vein. Sloughing and secondary infection are extensive. Progressive excavation and widening of the ulcerated area occurs. The upper border of the zygoma is exposed and of the adjacent orbital structures. Radiation is peculiarly ineffective. The recurrent hemorrhages usually cause fatal termination.

Group 3 underlying dense integumentum

(a) *Angulae ad nasi*. At this point the nasal cartilages the platysma facial muscles and the risorius unite. This area is very thin as anyone may observe by placing the index finger beneath the upper lip and palpating externally with the other hand. At the same time the fibers of the risorius may be palpated as they course downward to the canine fossa.

The integumentum is very dense and fibrous. One may very easily confuse the epidermoid type of lesion beginning on the skin in this region with a very radiosensitive type beginning in the nasal mucosa.

The epidermoid type is resistant to radiation and unless dealt with vigorously produces a chronic indurated ulcer which will not heal. The problems in these cases are extremely difficult—continued radiation tends only to increase the fibrosis without affording an opportunity for sufficient nutriment to cause healing to extend to the surface.

Group 3 (b) *the scalp*. The scalp is very large embracing the area from the supraciliary ridges anteriorly to the superior curved line posteriorly. The traditional five layers are of great importance because the three thickest layers are very mobile. The fourth layer being loose areolar tissue permits this motion.



F 3



F 4



F 5

Fig 3 C m e m l a p o m u n
 Fig 4 B s o c e l l a c r c o m f y s d t I e s p o 1 t o r a d i
 Fig 5 S l k t t m p l e g o A t u l s t f m l g t u n
 o f s u b j t t r u t

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very useful purpose in that patients so afflicted seek adequate medical service early

The treatment of choice is radium irradiation for the growths are basocellular and are very radio sensitive. Great care must be exercised in applying the radium so that the entire field is treated as recurrences are attributable to poor technique

The tarsal plate offers the *piece de resistance*. Involvement of this cartilaginous structure increases the gravity of the prognosis. Of all the various types of lesions previously described this is the most benign and responsive. It is the occasional deeply eroding inadequately irradiated case which demands our attention (Fig 8)

CONCLUSIONS

1 The anatomical factors influencing the prognosis in carcinomata of the skin of the face are reviewed

2 An attempt is made to correlate the anatomical structures influencing the prognosis in varying situations and to group them for clarity

3 Treatment is briefly reviewed

We have tried to show that the histopathological picture is only one aspect of the disease and at present an overemphasized one

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The periosteum of the cranium forms the fifth layer and is termed the pericranium.

Lesions of the scalp are rather uncommon but are usually well advanced if they lie above the hat line. We have seen patients with extensive growths concealed for years from their families by the continuous wearing of a hat by the female or a skull cap by the male. The lesions above the hat line are of two types (1) cauliflower with a small pedicle and (2) an ulcerative perforating type. The latter type is most malignant for the neoplasm will erode the skull producing death by rupture of underlying blood sinuses.

The most common site for neoplasms of the scalp is the forehead probably due to the exposure to sun and wind. These lesions begin as senile keratosis and progress very slowly and ulcerate late.

The occipitofrontalis fascia acts as an effective barrier for a long time because of its tendinous avascular nature. Should the patient delay too long we find that the fourth and fifth layers have been penetrated thus preventing any movement of the scalp in this particular area. Once the pericranium is involved the subjacent bone also is a locus.

Treatment in these latter patients may be successful if thoroughly carried out. An area of the scalp at least 1 centimeter beyond the borders of the lesion must be excised by the electrocautery down to and including the pericranium. If the bone is not involved and the inner surface of the periosteum is normal nothing more need be done unless the pathologist demonstrates internal involvement.

If early involvement is noted on the inner surface of the pericranium the outer table of the skull must be removed. This is not a formidable operation and is readily accomplished. Should there be involvement of the outer table a complete section of the skull must be removed. This is the work of the neurologic surgeon.

Many patients may be cured by removing the pericranium but this operation frequently leaves a denuded area of bone which epithelializes with difficulty. We have been very successful in aiding healing by drilling numerous holes in the outer table with the dentist's burr allowing the drill to go just deep enough to

secure seepage of serosanguineous fluid. Crusts rapidly grow upward and the epithelium spreads rapidly over this fresh surface (Fig 6).

Group 4 underlying cartilage (a) The nose. Lesions involving the underlying cartilage of the nose are very common but as they are so conspicuous they receive early and protracted treatment. There is probably no lesion so amenable to treatment and yet more universally incorrectly handled.

The earliest lesion is a flaking of the epithelium with a continued heaping up of the yellowish epithelial debris. The brownish surface discoloration seen in senile keratosis elsewhere is frequently absent. These yellowish oily flakes continue increasing in thickness and and if scraped off leave an irregularly pitted non hemorrhagic surface. At first bland later irritating ointments are prescribed by the average practitioner. In the course of time blood seepage occurs upon the removal of the crust and subsequent crusts become thicker and darker due to blood admixture. By this time the skin and underlying fascia are seriously involved. The cartilage is very resistant and does not become involved until quite late in the disease however once it becomes involved mutilation is required to effect a cure (Fig 7).

Massive X-ray dosage as recommended by Evans and Leucutia may result in cure but with the distinct danger of perichondrial damage. Continued small dosage is worse than useless. Electrodesiccation under local anesthesia is the ideal method of therapy because it destroys the growth accurately with the minimum of mutilation. Cartilage can be removed accurately and quickly. Healing is rapid with little scarring. No patient so treated should be discharged as cured. Quarterly inspections are necessary and the radiologist should pay particular attention to the interior of the nose for a recurrence may take place in the inside of the nose and not be visible on the outside.

Group 4 (b) the lower eyelid Lesions of the lower eyelid may begin on the free surface of the skin or on the lid margin and may present a red granular raised surface which bleeds freely. This continuous hemorrhage serves a

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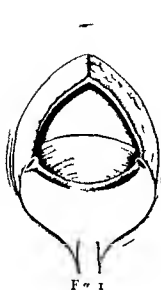


Fig 1

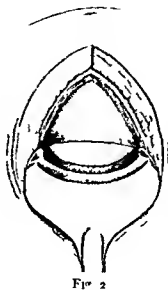


Fig 2

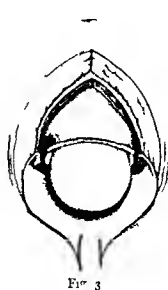


Fig 3



Fig 4

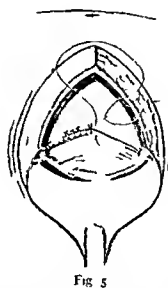


Fig 5



Fig 6

Fig 1 Median suprapubic incision exposing the lower uterine segment. The vesical peritoneum is incised transversely where it is loosely attached slightly above the bladder reflection.

Fig 2 A flap of peritoneum is separated with the bladder which is held under the symphysis by a Doyen's tractor. A curved transverse incision is made in the lower segment with bandage scissors to protect the child's head. The membranes are pushed through the incision.

Fig 3 The vertex is delivered by raising it with the left hand and making pressure on the fundus with the right hand. In the presence of contractions the child is delivered by making traction on the feet.

Fig 4 The cervical incision is sutured in two layers the first with interrupted sutures the second with a continuous stitch burying the first layer. No 2 chromic catgut is used throughout.

Fig 5 The edge of the bladder peritoneum is sutured to the uterus in the middle line at a point above the cervical incision. The two ends of the stitch are left long and attach the bladder peritoneum to the uterus on one side then on the other. The cervical incision is now retrovesical.

Fig 6 As the uterus contracts the bladder rolls over the lower uterine segment so that no catgut is exposed to the general peritoneal cavity.

feet. One cubic centimeter of pitocin is injected in the thigh muscles at this time. If the patient has had no labor or if the cervix is but slightly dilated at the time of delivery, the placenta and membranes are expressed through the incision. If on the other hand the cervix is fully dilated the cord is dropped in the uterus and the placenta

is expressed through the vagina after the closure of the cervical incision and the suture of the peritoneal flap to the uterus. There is very little hæmorrhage from the transverse incision.

Third step Closure of the cervical incision and suture of the peritoneal flap. The cervical incision is closed in two layers the first with interrupted

CLINICAL SURGERY

FROM DEPARTMENT OF GYNECOLOGY AND OBSTETRICS CARNEGIE HOSPITAL

THE TECHNIQUE OF THE TRANSVERSE CERVICAL CÆSAREAN SECTION

LOUIS E. PHANEUF, M.D., F.A.C.S., BOSTON

Pfizer Gynecology Textile Co. 1 School Chiffon Serv. Dp. tm. t. Gynecology d. Obst. tr. C. m. y. H. p. tal

IN 1907 Frank of Cologne advised placing the incision in the lower uterine segment rather than in the body of the uterus in performing cæsarean section. This method had been devised for neglected infected and potentially infected women who could not be delivered through the natural passages. At first the low or cervical cæsarean section received but little consideration. During the last 15 years the available literature shows that this method is increasing in popularity and that in some clinics it has replaced entirely or almost completely the corporeal or classical type of cæsarean section. Because of the better results obtained by the cervical operation its range of applicability has been increased to include the clean case as well as the infected one.

In the performance of cæsarean section the lower uterine segment may be approached in one of three ways: (1) by the extraperitoneal route represented by the Latzko type of operation; (2) by the transperitoneal route where the visceral and parietal peritoneum are united creating a so-called extraperitoneal space as described by Veit Fromme Hirst; (3) by the intraperitoneal route in which case the bladder is separated from the lower segment, an incision is made in the cervix which after delivery and closure is covered over by the bladder thus making the uterine incision retrovesical, retroperitoneal or subperitoneal.

This last type of operation is the one in common use today. The cervix may be opened by a longitudinal or transverse incision. The success of the operation in so far as good healing is concerned depends upon placing the entire incision within the limits of the lower uterine segment. In making the incision longitudinally it is possible to extend it into the body of the uterus when delivering a voluminous fetus. This may result in a weak spot at the upper end of the incision as I have observed it. The transverse incision offers

three distinct advantages, namely: (1) it avoids encroaching upon the uterine musculature and allows the placing of the incision entirely in the lower segment; (2) the bladder separation does not have to be carried as far downward; and (3) repeated operations are simpler to perform.

After personally performing 427 cervical cæsarean sections, 220 with a longitudinal incision and 207 with a transverse incision, my preference is decidedly in favor of the latter.

TECHNIQUE OF THE TRANSVERSE CERVICAL CÆSAREAN SECTION

First step. Abdominal incision. The patient is catheterized, anesthetized and placed in the Trendelenburg position. The abdomen is opened by a median incision about 6 inches long starting at the symphysis and ending near the umbilicus. The peritoneal cavity is entered between the bellies of the recti muscles. A Doyen retractor is introduced at the lower angle of the incision and the lower uterine segment is well walled off with a long strip of gauze. One cubic centimeter of gynergen is injected in the thigh muscles at this time.

Second step. Cervical incision, delivery. The uterine peritoneum where it is loosely attached above the bladder reflection is incised transversely and the bladder is pushed downward. The Doyen retractor is now placed over the bladder to protect it. The assistant makes traction upward on the uterus to bring the lower segment near the surface. A small transverse incision is made with a knife as low as possible in the cervix in the median line; this is extended laterally with bandage scissors, curving the incision upward. This is done so as to give more room. The child is delivered by raising the head with the hand and making pressure on the fundus. Forceps are rarely necessary. If the breech presents the infant is naturally extracted by the

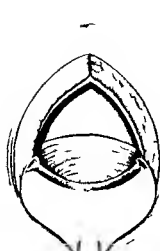


Fig 1

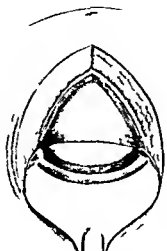


Fig 2

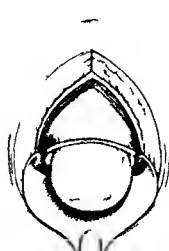


Fig 3

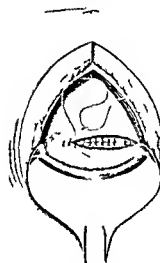


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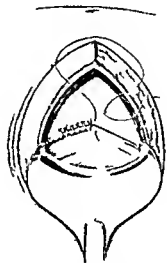


Fig 5

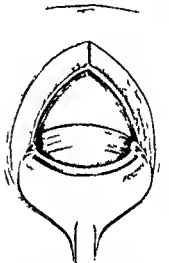


Fig 6

Fig 1. Med an suprasymphysal incision exposing the lower uterine segment. The visceral peritoneum is incised transversely where it is loosely attached slightly above the bladder reflection.

Fig 2. A flap of peritoneum is separated with the bladder which is held under the symphysis by a Doyen retractor. A curved transverse incision is made in the lower segment with bandage scissors to protect the child's head. The membranes are peeling through the incision.

Fig 3. The fetus is delivered by raising it with the left hand and making pressure on the fundus with the right hand. In both presentations the child is delivered by making traction on the feet.

Fig 4. The cervical incision is sutured in two layers the first with interrupted sutures the second with a continuous stitch burying the first layer. No 2 chromic catgut is used throughout.

Fig 5. The edge of the bladder peritoneum is sutured to the uterus in the middle line at a point above the cervical incision. The two ends of the stitch are left long and attach the bladder peritoneum to the uterus on one side then on the other. The cervical incision is now retroesical.

Fig 6. As the uterus contracts the bladder rolls over the lower uterine segment so that no catgut is exposed to the general peritoneal cavity.

feet. One cubic centimeter of pitocin is injected in the thigh muscles at this time. If the patient has had no labor or if the cervix is but slightly dilated at the time of delivery the placenta and membranes are expressed through the incision. If on the other hand the cervix is fully dilated the cord is dropped in the uterus and the placenta

is expressed through the vagina after the closure of the cervical incision and the suture of the peritoneal flap to the uterus. There is very little hemorrhage from the transverse incision.

Third step. Closure of the cervical incision and suture of the peritoneal flap. The cervical incision is closed in two layers the first with interrupted

sutures and the second with a continuous suture. No. 2 chromic catgut being used the first layer takes in the endometrium and part of the muscle; the second layer takes in the remainder of the myometrium and the fascia of the lower uterine segment and completely covers the first layer. The peritoneal edge at the bladder reflection is now sutured to the uterus above the cervical incision in the middle line with a suture of No. 0 chromic catgut the ends of the catgut being left long, one end approximating the peritoneum to the uterus on one side and the other to the other side thus completely covering over the transverse cervical incision and making it entirely retrovesical.

Fourth step Closure of the abdominal wall. The gauze strip is now removed the omentum is brought down (intestines are practically never seen during this operation) and the abdominal wall is closed in layers in the usual way.

This operation may be readily performed under local infiltration and spinal anesthesia. For local anesthesia a 1 per cent solution of novocain is employed. For spinal anesthesia depending upon the weight of the patient 100, 120 or 150 milligrams of sterile novocain crystals are dissolved in 2 to 3 cubic centimeters of spinal fluid and re injected. Solutions of novocain lighter than spinal fluid are never employed in our department.

FROM THE SURGICAL CLINIC OF THE MEDICAL COLLEGE OF VIRGINIA

OPERATION FOR TUMORS OF THE BLADDER

G PAUL TAROQUE M.D. F.A.C.S. RICHMOND VIRGINIA

PAINLESS or nearly painless hæmaturia calls always for a thorough urological study

When through the cystoscope we see a bladder tumor even of small size located at some distance from the ureteral openings excision of the portion of bladder involved will be the logical treatment provided that to do so would not entail special danger of the operation itself. Tumors located so close to the ureteral orifice as to make wide excision impracticable without added risk from injury of the ureter may call for the use of fulguration of the tumor with fair prospects of cure but few surgeons would feel as much satisfaction after treating such a tumor by fulguration as if a wide excision could have been performed.

For extensive bladder tumors of long standing radical cure is not apt to be possible unless complete removal of the bladder and transplantation of the ureters may prove to be effective.

For tumors located at a safe distance from the ureters especially in the fundus of the bladder operative excision is today the method of choice. There are two dangers however in attempting to remove bladder tumors through an ordinary extra peritoneal incision into the bladder one that removal of the tumor would entail accidental opening of the peritoneal cavity the other that when guarding against this accident the tumor may not be completely removed. Incomplete operations for cancer of any organ are followed by rapid spread of the malignant disease.

In January 1930 Herbert Sugar in *SURGICAL GYNECOLOGY AND OBSTETRICS* described a method of securing a complete exposure of the entire bladder which he attributes to Voelcker.

I employed this method first in May 1930 and again in January 1931 in two patients both of whom had large cancers of the fundus of the bladder. In both cases the operation was quite easy of performance the electrosurgical needle was employed satisfactorily for making excision convalescence was totally uncomplicated the patients were out of bed in 10 days and the wounds were healed in 2 weeks. It is now more than a year since the first patient was operated upon. He has no sign of local recurrence or distant metastasis and he works hard and considers himself in good health.

STEPS OF THE OPERATION

Spinal anæsthesia is employed and the patient is placed in the Trendelenburg position. The skin muscle and fascia are divided in a transverse direction. The linea alba is divided to a point an inch or two above the transverse incision through the fascia and the recti and pyramidales muscles are easily separated by retractors. The prevesical fat may be brushed aside thus bringing into good view the flap of peritoneum which is attached to the top of the bladder quite tightly. No attempt should be made to separate this area of peritoneum at its point of attachment to the bladder on account of the liability of tearing the peritoneum. Instead the peritoneal cavity is deliberately opened in the transverse direction by an incision which is carried to each side 1.5 to 2 inches. With the bladder caught at its top by forceps and pulled upward another incision is made through the peritoneal covering of the bladder at a point about 1 inch below its highest attachment. With a knife handle or gauze covered finger the peritoneal covering except at the vertex can be brushed down with surprising ease so that the entire bladder is extraperitonealized down to the rectum and the ureters and large vessels are brought into view. When this is done the bladder is held up and the peritoneal cavity is closed with great pains to place the sutures close together and the edges in neat apposition. A gauze sheet is now placed over the line of

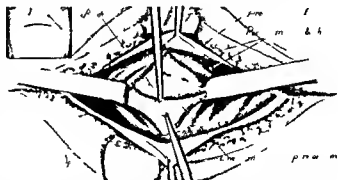


Fig 1. The transverse incision is made through the skin and deep fascia. The lower recti and pyramidales muscles are pulled apart the prevesical fat is brushed down the peritoneum is exposed and held on forceps preliminary to transverse division.

which are the rectal pte

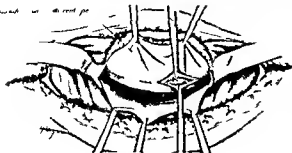


Fig 1



Fig 2



Fig 3

Fig 4
 d th p t m g th bl dd h b d d d
 b p l d f f m th bl dd
 F 3 Th p r t m h b b h d m p l t l y f f
 d t th eck f th bl dde d th p t l ty
 b g l d h l th bl dd s b h l d p h e t s
 F 4 Th p t m w l d g h e t s
 p l c d th t m p to m t p t
 t m t f t th bl dd h b p d t t h
 f d

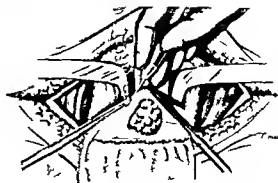


Fig 5

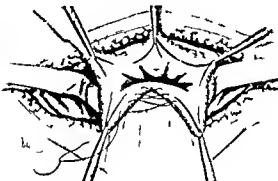


Fig 6

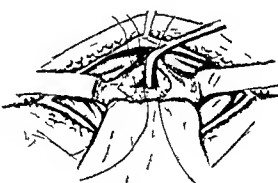


Fig 7

F 5 Th bl dde h b p e d a l f th
 bl dd ou d g th t n h l d bet l m p d
 b c d by l c t l d l
 F 6 Afte f th l f bl dd d
 th t m the bl dd b t d
 F 7 Th op th f d th bl dd b
 cl d d sm l l p p b d

sutures into the large space made by enucleation of the bladder to protect the line of sutures and cellular tissue against contamination in the next step of the operation namely the opening of the bladder

The bladder is opened at the uppermost portion and a thorough inspection of the entire interior is

made. A wide area of bladder surrounding the tumor in all directions is clamped off as shown in the illustrations and with an electrosurgical cutting instrument an area (in my 2 cases an area the size of the palm of one's hand) is excised with a coagulating current each edge is touched in other locations and finally the forceps with which

it is clamped are touched several times with the electric instrument to coagulate the tissue and prevent bleeding. The forceps are now removed and the edges of the bladder sutured first by a so called baseball stitch and over this a simple running suture is applied from behind, as a means of making snug apposition and further to control bleeding.

A small right angled suprapubic drain is placed in the bladder and the bladder is closed snugly

about this tube. We have not employed drainage into the extravescical space from which the peritoneum has been separated.

One of our patients was 45 the other 70 years old. In one the growth was considerably larger than a silver dollar and was of the infiltrating type in the other it was slightly larger than the distal phalanx of a large thumb and had a broad pedicle. Both tumors upon microscopic examination were shown to be carcinomata.

GYNOPATHIC BACKACHE

A STUDY OF ITS NATURE AND THE MECHANISM OF ITS PRODUCTION WITH SPECIAL REFERENCE TO UTERINE RETROVERSION¹

ARNOLD STURMIDORF M.D. F.A.C.S. NEW YORK

IN the entire range of subjective gynopathic manifestations backache is one of the most familiar and least understood as to its nature its direct cause and the mechanism of its production

Ward quoting from the records of the Woman's Hospital in New York states Our statistics show that approximately 85 per cent of our gynecological cases complaining of backache are caused by gynecological pelvic disease and the remaining 15 per cent by orthopedic or non surgical conditions

Lynch in an analysis of 1041 gynecological cases found that 49 per cent had sacral or lumbar backache of these 76.5 per cent were due to a gynecological condition 7 per cent were of doubtful etiology and 16.5 per cent were definitely orthopedic

This prevalence of backache in gynopathic conditions has so habituated us to their concurrence that a direct relationship of a condition and a symptom is tacitly accepted without further investigation as to the how and why the one produces the other

Gynecological literature is very indeterminate on this phase of the subject the prevailing concepts being based largely upon various conjectural implications of purely concomitant factors none of which exhibit that constancy of clinical parallelism essential to establish the direct relationship of cause and effect

Ward's paper the most recent and comprehensive resume of these prevailing concepts states The most frequent direct cause of gynecological backache is pelvic congestion Any condition that will produce this state is an etiological factor as for example retrodisplacements with and without complicating inflammatory disease lacerated cervix with cervical infections menstruation and constipation Continuing Ward enumerates

Traction on ligaments and supports of the pelvic organs pressure from fibroids cysts and exudates on the cervical ganglia of the sympathetic nervous system in the region of the cervix rectum and uterosacral ligaments and on the roots of the sacral nerves as productive of referred backache

Bullard in a statistical study of 721 cases of backache from the service of the Woman's Hospital in New York pointedly comments on 15 cases of the series 47 of which presented adherent retroversion with inflamed adnexa 20 uncomplicated mobile retroversion 20 prolapse of varying degree 9 of procidentia and 29 complex cases not one of which complained of backache

It is noteworthy that this group of cases embodies every alleged causative factor of backache and yet not one of the group complained of backache

More significant is the item in Bullard's analytical summary of his statistics which shows that in 15 cases out of every hundred the backache persisted after otherwise successful correction of gynopathic conditions

These quotations from the current literature will suffice to reveal first that the majority of gynopathic patients suffer from backache second that a lesser number presenting identical lesions do not suffer from backache third that an appreciable number are not relieved of their backache by apparently successful corrections of their gynopathic disorders

What the literature does not reveal is how the backache is produced in the first class what particular factor determines its absence in the second and finally why apparently successful corrections fail to relieve the third class

The modern trend of advanced clinical procedure subjects every regional manifestation of disorder to a most searching analysis of its various phases critical inspection accurate localization chemical and biological aids are invoked in tracing the links from cause to effect and yet how many gynecologists direct even a single glance of superficial inspection to the aching back of a gynopathic patient until its postoperative persistence impels a closer search for its cause?

THE NATURE OF GYNOPATHIC BACKACHE AND THE MECHANISM OF ITS PRODUCTION

Primarily a gynopathic backache is essentially an intermittent atitudinal spastic backache characteristically located at the sacrolumbar

BACKACHE AND RETROVERSION

Clinically uterine retroversion as a potent factor in the causation of backache continues to dominate gynecological practice while academically this concept invokes the most contradictory expressions of opinion. Thus Jaschke quoted by Ward after comparing 1 000 cases of retroflexion with 1 000 cases of antelexion affirms that there is no symptomatic difference to be noted in the two forms.

Theilhaber of Munich and Cabot of Boston quoted by Ward emphasize the existence of symptomless uncomplicated retroversion of the uterus.

Graves on the other hand in an analysis of 500 cases of retroversion from all causes states that sacral backache was a definite symptom in 1/6 per cent. He concludes that there can be no doubt whatever of the fact that retroversion of the uterus does cause backache.

Operative gynecology to date records over 100 detailed methods for the correction of uterine retrodisplacements. Every one of these methods at the hands of its promulgator will undoubtedly convert the retroposed into an anteposed uterus but notwithstanding their faultless postoperative uterine poise a number of these patients continue to suffer from backache and some more so.

Bullard estimates that 15 per cent of the surgically corrected retroversions continued to suffer from backache.

Hurd in a recent publication states. The question as to what percentage of all varieties of retroversion gives rise to symptoms would appear to be a difficult one to answer and could be solved only by routine pelvic examination of a large series of women taken at random.

In this tabulated study of 1 000 patients with retroversion Hurd found only 17 per cent who complained of backache and he concludes that this series fails to verify the generally accepted teaching that backache is a classical complaint in simple retroversion.

In this series of 1 000 cases representing the various types of operations in vogue Hurd reports 40 immediate anatomic failures a series of late recurrences after an average period of 10 months and complete symptomatic failures in 12 per cent of the patients. He incidentally interpolates a very relevant observation with regard to the anatomic failures namely that 3 out of 5 were relieved of the symptoms for which they were admitted regardless of the recurrence of the displacement.

A most significant observation for it justifies the conjecture that the relief of backache attrib-

uted to the surgical correction of uncomplicated mobile retroversion is a *post hoc ergo propter hoc* assumption in three fifths of the cases and it would seem reasonable to contend that correctly applied pessaries would have yielded the same results.

The controversial crux in the problem centers in the question. Where does normal uterine poise end and pathogenic retroversion begin?

A definite answer to this question will be reached only when the dynamic factors that dominate intra abdominal topography in general and uterine poise in particular are more clearly visualized.

The prevailing concept of normal uterine poise is based exclusively upon purely anatomic details which do not reveal the mechanism involved in the maintenance of this poise.

Uterine poise is not simply a question of ligamentary or musculo-fascial support. There is not a ligament or muscle attached to the uterus that could permanently resist the displacing force of intra abdominal pressure and the active physiological expulsive power normally manifested within the pelvis.

A force capable of expelling a full term fetus would permanently displace an empty uterus with every strain at defecation unless minimized or dispersed by deflection. The ligamentous and musculo-fascial elements serve to maintain uterine poise not by virtue of their structural resistance to displacement but as integral parts of a complex mechanism that deflect the displacing force of intra abdominal pressure.

The term normal uterine poise must be conceived as a purely relative and not as a positive designation. The structure form and topographic relations of the uterus necessitate a range of mobility that reaches normally from the symphysis to the sacral promontory. In infancy its long axis approximates the vertical which gradually descends through an arc of 45 degrees to form a right angle to the plane of the pelvic brim at maturity.

This developmental change of poise is not due to a forward and downward rotation of the fundus but to a downward and backward rotation of the pelvis at the sacrolumbar junction.

If an infant be placed on its back and its legs be drawn down from their habitual attitude of semiflexion it will be noticed that the range of extension is limited by the absence of the lumbar curve and pelvic incline. When gain in the muscular development enables the infant to stand the erector spinae draws the trunk upward against the resistance of the iliopsoas group and ligaments

articulation involving the lower erector spinae and upper iliopsoas muscle segments which control the mobility of the sacrolumbar articulation

This spasticity is a reflex protective immobilizing phenomenon analogous to that found in the anterior abdominal wall pathognomonic of deep seated irritative processes

If a mild galvanic current be applied to the normal sacrolumbar musculature it induces no painful response the same current applied to the gynopathic back intensifies the spasm and augments the pain—a test for myospasm familiar to neurologists

It is not generally recognized that normally the sacrolumbar articulation and its resulting pelvic tilt do not present a fixed but a constantly varying angle While the adult spine as a whole presents apparently fixed contours it is nevertheless very flexible especially in its lumbar segments This flexibility is due to the elastic resiliency of the intervertebral discs

Dwight quoted by Whitman states The intervertebral discs constitute 41.9 per cent of the cervical 26.4 per cent of the dorsal and 44.6 per cent of the lumbar region where the widest movements of the trunk are carried out Thus under normal conditions the sacrovertebral angle with its resultant pelvic incline is subjected to constant adaptive variations the pelvis dipping and rising with every contraction of the sacrolumbar musculature in automatic response to all postural and attitudinal demands

These physiological contractions of the sacro lumbar musculature become pathologically spastic in the presence of intrapelvic disorder the purpose of the spasticity being a protective immobilization of the pelvis at an angle posterior to the perpendicular line of intra abdominal pressure in other words a painful spastic augmentation of the normal pelvic dip occurs which deflects and minimizes pressure from above

The dynamic resultant of this deflection between the abdominal and pelvic cavities is convincingly demonstrated by G. H. Noble who in a study of Intra abdominal Dynamics etc states Normally an intra abdominal pressure of 80 millimeters at the pelvic brim is reduced to 60 millimeters at the cervix 40 millimeters in the vagina and 20 millimeters at the vulvar outlet In other words the force of intra abdominal pressure is reduced to one fourth of its initial intensity by intrapelvic deflection

The myospasm exaggerates the lumbar curve narrows the lumbosacral angle rotates the promontory down and forward the coccyx up

and backward on a transverse axis thus interrupting the direct continuity between the pelvic and general abdominal cavities

Omitting all further delineation of the reciprocal and harmonious deflections of pressure exercised by the pelvic planes and pelvic floor musculature the details of which are fully elaborated in another publication (10) it will suffice here to state concretely that the promontory of the sacrovertebral angle may be likened to a hinged watershed which automatically changes its angle to divert pressure from above the hinge becoming spastically locked in the presence of gynopathic conditions

Obviously the range of flexibility in the sacrolumbar angle must be dominated by the structural conformation of the individual spine

Routine examination of spinal contours will reveal a wide divergence in anteroposterior outlines and mobility which is most pronounced in the sacrolumbar area since the lumbar curve varies in different spines from an almost rigid flat vertical to a concavity bordering on the lordotic

In an illuminating contribution on this subject Dickinson and Truslow characterize the two extreme anteroposterior spinal deviations from the normal as the kangaroo and the gorilla types

While the illustrations in Figure 1 are purely schematic they indicate first the variants in the individual depth of the sacrovertebral angle among different spines second the dominance of this angle on the pelvic tilt third the influence of the pelvic tilt on the direction of the axis of the pelvic inlet The nearer the oblique axis of the pelvic inlet approaches the vertical the greater the intensity of direct intrapelvic pressure from above

Such marked deviations in structural conformation necessarily imply a corresponding diversity in functional mobility and it follows as an obvious corollary that the wider the mobility range the less strain upon the lumbosacral musculature in tilting the gynopathic pelvis out of the vertical line of intra abdominal pressure and conversely the more limited the mobility the greater the muscle strain with eventual spasm productive of pain This explains why among different patients with identical gynopathic disorders some suffer slight backache some severe and others not at all

A trained female contortionist with gynopathic disorder would be less likely to suffer from sacrolumbar myospasm than a similarly afflicted seamstress

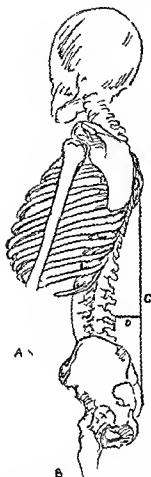


Fig. 2. A Axis of plane of pelvic brim B Plane of pelvic brim C Vertical D Lumbosacral angle Note that the depth of the lumbar curve D is an approximate index of the lumbosacral angle and its resultant pelvic incline

In the pelvis the osseous or fixed planes may be designated expulsive planes inasmuch as they tend to deflect the direction of pressure into line with the pelvic outlets. The familiar action of these planes in parturition may serve as an apt illustration of their dominating influence within the pelvis.

In the same sense the musculofascial or mobile planes are retentive in so far as they deflect or diffuse pressure in directions that tend to maintain the topographic stability of the pelvic organs.

According to a fundamental law in dynamics.

The direction of a given force impinging against a resistant plane becomes deflected in a fixed and definite direction the angle of deflection being governed by the angle of the resistant plane. It follows as a natural corollary that uterine poise is determined by the individual pelvic poise the long axis of the normal mobile uterus always coinciding with the axis of the plane of the pelvic brim. Every degree of pelvic angulation at the sacrolumbar junction determines a coincident



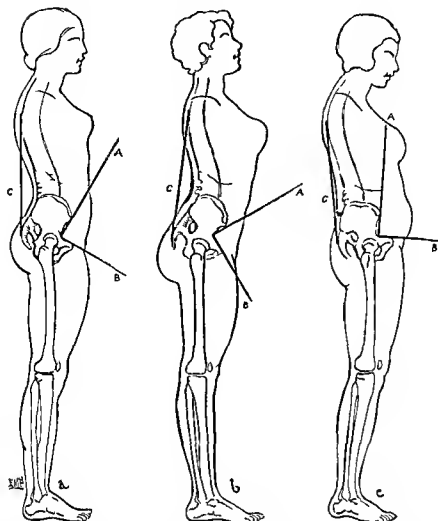
Fig. 3. The edge of a ruler held vertically in contact with the spinous processes of the lower dorsal and sacral vertebrae spans the intervening lumbar hollow. The distance in millimeters from the deepest point of this hollow to the anterior edge of the ruler presents an index of the lumbosacral angle with its resultant pelvic incline and indicates the uterine poise normal to that incline.

angle of uterine poise through an arc ranging from the symphysis to the sacral promontory, hence as one sacrolumbar angle with its resultant pelvic incline differs from another so the incline of the uterine poise must differ one from another and what is normal in the one is abnormal in the other.

Every degree of sacrovertebral angulation is necessarily evidenced by a corresponding depth of the lumbar hollow, which thus presents an approximate measurable index of the pelvic tilt as a whole and incidentally indicates the uterine poise normal to that angle.

To obtain this index the patient with back exposed assumes her natural relaxed standing attitude while the edge of a ruler held vertically in contact with the spinous processes of the lower dorsal and sacral vertebrae spans the intervening lumbar hollow (Fig. 2).

The distance in millimeters from the deepest point of this hollow to the anterior edge of the



The normal backward tilt of the pelvis is maintained by the normal backward tilt of the uterus. In such vertical pelvis the only tenable position for the uterus is vertical and leaning to retroversion. Concisely stated, uterine poise is the resultant of deflected intra-abdominal pressure. The entire abdominal cavity constitutes a complex deflecting chamber presenting multiple planes, some of which are fixed, others mobile, that deflect pressure at various and varying angles to each other along fixed and definite lines.

of the hip joint bending the lumbar spine into its physiological curve (Whitman 6)

In other words, under normal development the erect attitude is attained by a forward flexure of the lumbar spine; the pelvis thus assuming an angle of 60 to 65 degrees with the tip of the coccyx on a horizontal level with the lower border of the symphysis pubis.

In conditions of arrested development the upright attitude is induced not by flexure of the lumbar spine but by a vicarious up and rotation of the entire trunk on the femoral joints; the pelvic brim mounting the infantile vertical axis.

Every stage of arrested development in the normal backward tilt of the pelvis must of necessity be reflected in a corresponding tilt of the uterus. In such vertical pelvis the only tenable position for the uterus is vertical and leaning to retroversion.

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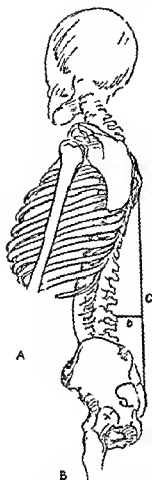


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ruler presents an index of the lumbar curve and incidentally the degree of lumbosacral angulation with its resultant pelvic tilt. In taking this index it is essential that the ruler approximates a true vertical.

In an extensive series of observations this lumbar index ranged from 10 to 45 millimeters (9).

An index of 20 millimeters marks the extreme minimum compatible with normal anterior uterine poise. From 20 millimeters down the existence of a congenital retroversion of the uterus may be predicated in the majority of cases prior to its objective verification.

The occasional exception to this rule will on closer investigation reveal a kyphotic dorsal spine, an abnormally projecting sacral promontory, a markedly contracted conjugate diameter, a congenitally elongated cervix, a strained and deceptive pose assumed by the patient during the measurement or an acquired anteversion from co-existing gynopathic conditions for it is only reasonable to assume that just as a normally poised uterus may become retroverted so a congenitally retroposed uterus may become pathologically anteverted without invalidating the significance of the lumbar index.

In the infant a flat lumbar hollow is normal; in the adult it presents an arrested development and denotes a vertical pelvis. In these vertical pelvises the uterus necessarily assumes a poise leaning to retroversion and any procedure which converts such a retroposition into an anteroposition converts a compensated into a decompensated equilibrium among the pelvic contents. An uncomplicated mobile retroversion can not cause backache any more than an uncomplicated mobile anteversion; both phases of uterine poise being individually normal to their respective type of lumbosacral conformation.

This class of patients presents not only a shallow or flat lumbar curve but the general skeletal contours typical of the visceroprotic habitus in which backache is caused not by their uncomplicated mobile retroposed uterus but by the continuous attitudinal strain induced through constant automatic efforts to maintain an unstable poise within the lines of gravity. (Tru slow 3)

These congenital retropositions offer the most legitimate field for relief by correctly applied pessary and abdominal supports.

Dynamic related to this class are the backaches induced by the lordotic attitude necessarily assumed by patients with pendulous abdomen and those subject to the constant static oscillation due to the use of excessively high heeled footwear.

It would appear superfluous to enumerate for the sake of differential completeness all of the well recognized orthopedic neurogenic toxic and other extragynetic conditions productive of sacrolumbar pain any of which may enter the problem in the given case as the sole or complicating etiologic factor.

SUMMARY

Gynopathic backache is a spastic backache the gynopathic factor being one among many causes of myospastic pain in the lumbosacral area.

This form of myospasm is a protective phenomenon analogous to that observed in other muscular areas over deep seated irritative lesions.

It protects the inflamed pelvic viscera by tilting the pelvis out of the direct line of intra-abdominal pressure.

A normal range of mobility at the sacrolumbar articulation responds to this protective demand without undue muscle strain and hence without pain.

On the other hand any structural or functional limitation of the essential mobility range in the sacrolumbar joint induces muscle strain manifested by spasticity and pain.

The relative degree of restriction in lumbosacral mobility will determine the intensity of the muscle strain and its resulting pain.

The conformation of the sacrolumbar angle determines the angle of uterine poise. The term normal uterine poise is purely relative.

The poise of the uterus is normal when its long axis coincides with the axis of the plane of the pelvic inlet.

As this axis varies with the angle of the individual sacrolumbar junction so the uterus presents its coincident variation in poise ranging from the symphysis to the sacral promontory. A uterus in this poise does not cause backache and its surgical anteversion does not cure backache.

The depth of the lumbar hollow offers an approximate index of the sacrolumbar angulation and its incident uterine poise.

A mobile retroversion at an angle not coincident with the axis of the plane of the pelvic inlet presents a pathological displacement in which not the displacement as such but the cause of the displacement is the cause of the backache.

Finally Mills in an exhaustive orthodiagraphic study of Bodily Habitus in Relation to Visceral Form Position Tonus and Mobility concludes that Certain types of physique are associated with definite types of visceral topography.

All these types are adaptively compatible with normal function and comfort.

This dictum applies with equal validity to un-
complicated mobile retroversion in relation to
gynopathic backache

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A SURGICAL APPROACH FOR THE REMOVAL OF CERTAIN PINEAL TUMORS

REPORT OF A CASE

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THE sum total of medical literature pertaining to the surgical treatment of pineal gland tumors is extremely small. The reasons are obvious. In the first place tumors of this gland are relatively uncommon. In the clinic of Dr. Cushing there were in 1925 records of 12 histologically verified cases or approximately 1 per cent of the total number. Only 81 well described cases have been found in the literature. Very few of these cases were ever treated surgically. Then too the incentive to report surgical measures taken for the removal of any tumor if unsuccessful is not great.

In 1913 Rorschach reported an attempted extirpation through the posterior fossa with a fatality. In 1914 Pussep attempted an extirpation by an approach above the cerebellum dividing the right lateral sinus and the tentorium. The attempt also was unsuccessful. In 1921 Dandy reported the exposure of 3 tumors localized by ventriculography in the region of the pineal gland through an approach whereby he retracted the right hemisphere laterally divided the posterior portion of the corpus callosum and entered the third ventricle from above. One of these tumors exposed proved to be an infiltrating glioma of the cerebellum and no attempt was made to remove it. The second proved to be an encapsulated tubercle of pineal gland. This was removed *in toto*. The patient survived 8 months. The cause of death was supposed to have been other tubercles in the brain. The third patient died some 48 hours after an operation at which the tumor was removed *in toto*. The tumor in this instance was a true pinealoma.

Far more frequent than the radical removal of these tumors have been simple palliative measures directed toward the relief of symptoms of an internal hydrocephalus. Such measures have consisted of simple subtemporal decompressions or attempted fistula formations between the third ventricle and the subarachnoid space at some point. This last procedure is worthless inasmuch as the fluid drains into the subdural spaces where absorption is almost nil. The fistulae soon close. A simple right subtemporal decompression supplemented by vigorous deep therapy radiation

may hold the growth of some small pineal tumors in check for a number of years. A few patients have lived for several years with a decompression only. However most of the patients with pineal tumors relatively soon reach a stage where the cerebrospinal fluid block becomes complete in spite of a decompression and radiation and some form of extirpation may well be considered. It is believed that a rational and feasible approach to most of these tumors is through the dilated right lateral ventricle. Such was the approach in the following case.

W. McPh. SMITH, 27 69 W. Main St., 34 Yrs. admitted to this hospital first on August 6, 1909, complaining of headache, fullness of head, double vision, the patient with mother of healthy children stated that he had been perfectly well until May 1, 1909. At that time she began to complain of attacks of general edema, double vision, and shortness of breath. She began to feel an ophthalmologist told her that she had glaucoma of the eyes. She was referred to the Brigham Hospital, where she had a localizing symptom of double vision, fullness of head, double vision, and general weakness. The patient had films taken by Dr. M. C. Smith and found to be normal. She was then referred to the local hospital where she was operated on by Dr. J. H. Smith. The operation was a failure. She was then referred to the local hospital where she was operated on by Dr. J. H. Smith. The operation was a failure. She was then referred to the local hospital where she was operated on by Dr. J. H. Smith. The operation was a failure.

At right time of admission, the patient was found to be a woman of 34 years, with a history of headache, double vision, and general weakness. She was admitted to the hospital on August 6, 1909. At that time she had been perfectly well until May 1, 1909. At that time she began to complain of attacks of general edema, double vision, and shortness of breath. She was referred to the Brigham Hospital, where she had a localizing symptom of double vision, fullness of head, double vision, and general weakness. The patient had films taken by Dr. M. C. Smith and found to be normal. She was then referred to the local hospital where she was operated on by Dr. J. H. Smith. The operation was a failure. She was then referred to the local hospital where she was operated on by Dr. J. H. Smith. The operation was a failure.

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Hospital: a mass projecting into the shadow of the air filled third ventricle. The size of the mass seemed about 1 centimeter larger in diameter than on previous ventriculogram films. There was no difference in the fluid removed from the two ventricles. The cell count serology and chemistry in each was normal.

Operation—first stage On March 13 a right parieto-occipital bone flap was turned down under novocain and ether anesthesia. The ventricles were tapped daily to relieve symptoms of intracranial pressure.

Operation—second stage On March 20 1930 under local and ether anesthesia the wound was reopened. Inspection of the cortex revealed nothing of note except flattened convolutions. A reversed L shaped incision 6 to 7 centimeters long was made in the cortex extending from the posterior end of the superior temporal lobe gyrus upward and slightly backward ending at the lobulus parietalis superioris (Fig 1). With the aid of the electrocautery the incision was carried downward into the ventricle without difficulty. The point of entering the ventricle was at the juncture of the temporal and occipital horns with the lateral ventricle (Fig 2). Wet cotton pledgets were placed in the opening of the ventricles to prevent blood or tumor debris gravitating into them. A cotton pledget was placed over the exposed choroid plexus to prevent injury. This proved to have been ill advised as considerable bleeding was encountered in separating the cotton from the meshes of the plexus at the end of the operation. A distinct bluish hue was to be made out in the depth of the wound. This was covered by the much thinned out medial wall of the lateral ventricle and was easily divided and removed with the electrocautery. The third ventricle was opened anterior to the tumor. The tumor lay between and above the large dilated *vena vorticosae* (Fig 3). It proved to be about 3 to 3.5 centimeters in diameter was grayish red in color soft smooth in outline and apparently not actually invading brain tissue at any point seen. Seedling of the tumor in the lateral or third ventricle was not to be made out. At its base however it was adherent to the tributaries of the vein of Galen. The surface of the tumor exposed was coagulated with the electrocautery and the desiccated portion removed with suitable forceps and with the help of a suction apparatus. By repeating this process several times the tumor was entirely removed except for a small bit adherent to the large adjoining veins. This was left inasmuch as the danger of uncontrollable bleeding from them was considerable. The wound was left perfectly dry and was closed without drainage.

Postoperative course The patient did well immediately following operation except for a persistent Rhot type of respiration which persisted for some 24 to 36 hours and a weakness of the left side. Some 48 hours after operation she became semicomatose and the wound was opened enough to insert a drain into the incision in the cortex. The patient's condition improved rapidly with the evacuation of blood and cerebrospinal fluid and a small amount of tissue debris. Within 12 hours she was again conscious. The drain was removed in 48 hours. The temperature following operation was elevated to 39-40 degrees C for 5 to 6 days and then fell to normal. A left sided weakness cleared up in about 1 week and strength on the two sides has remained normal up to date. A left homonymous hemianopsia was noted before discharge from the hospital and has persisted. The decomposition has remained very soft or at times sunken in. The discs are flat and show only moderate secondary atrophy. Deep reflexes are equal on the two sides and hyperactive. There is a slight hypoaesthesia to pin prick over the left side and from time to time an astereognosis on the left for test objects. This however is not enough to interfere with using the hand for ordinary housework.



FIG 1 Reconstructed drawing to show site and extent of incision in cortex—right side

There has not been any postoperative diabetes insipidus. Sleep disorders have been irregular and insomnia rather than somnolence has been the complaint. Menses were absent for some 5 to 6 months after operation but have returned to normal. A basal metabolism reading 1 month after operation was -20.

From a mental point of view she has been somewhat slower in returning to normal than anticipated. Incontinence of urine and faces were irregularly present for 2 to 3 weeks after operation. Where formerly she had been a very active almost hypomanic type of individual she has had a period of 2 to 3 months of moderate depression. This however has largely cleared up. Memory is good for remote events but on occasion moderately impaired for details of every day happenings. Ability to concentrate calculate and plan are moderately good. She is able to do a good part of the housework for the family of six people and in general the patient seems to her family and friends as mentally competent and an average normal.

Two deep therapy X-ray treatments have been given following operation inasmuch as a small fragment of tumor is known to have been left attached to large veins near its point of attachment.

Pathological examination The fragments of tumor were placed in Zenker's fixer and stained with hematoxylin and eosin and Mallory's phosphotungstic acid hematoxylin stain. Other fragments were placed in a 10 per cent solution of formaldehyde. None of the fragments destained by the electrocautery were saved. Sections were stained with Mallory's phosphotungstic acid hematoxylin stain. The tumor proved to be of the spongy blastoma type. Cells were grouped together in clusters and cords with strands of delicate connective tissue running between them supporting thin walled veins and capillaries. The cells have a heavily staining round nucleus and a fairly abundant pale staining granular cytoplasm. Mitoses are not seen.

The surgical approach for removal of tumors of the pineal gland through the right lateral ventricle

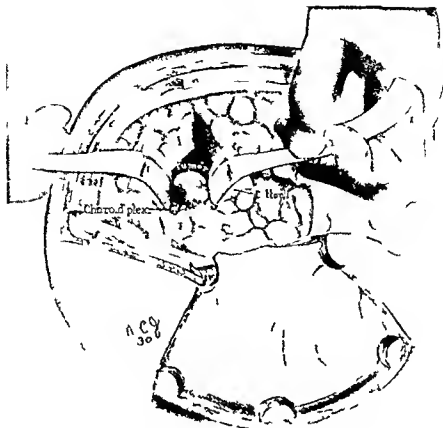
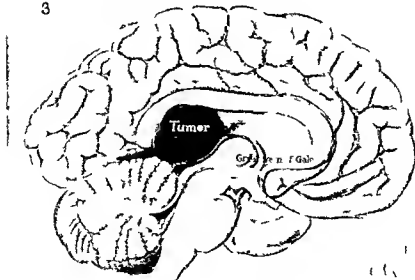


Fig. 2. Ep. ftum alt ente g hlt l ntr l d m gmd l
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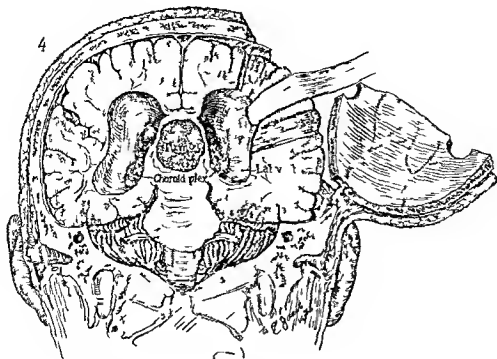


Fig 4 Frontal section to show relationship of tumor to corpus callosum and also lateral ventricles

is believed to be the logical one for most pineal gland tumors without much doubt it is the least vascular route. The only vessels of consequence that must be ligated before the tumor is exposed are the cortical veins which should offer little difficulty. The tributaries of the great vein of Galen about the tumor can be more easily seen and dealt with in an approach from the side inasmuch as such an approach is directly down on them. Removal of the tumor *in toto* is probably in most instances impractical and inadvisable since it may be more safely rongeuired away or aspirated after being desiccated with the electrocautery. The amount of injury to brain tissue from an incision of the cortex can be no greater than the softening resulting from ligation of veins entering the lateral sinus which must be done in exposing the third ventricle through the corpus callosum.

An approach to the region of the third ventricle by dividing one lateral sinus and splitting the tentorium of the cerebellum has little to commend it. The approach is directly through many of the large engorged tributaries of the vein of Galen which are difficult to ligate or control and may lead to still greater hydrocephalus and large areas of cerebral softening if ligated.

The contention that the majority of pineal tumors tend to grow posteriorly rather than anteriorly in the inferior colliculi is not borne out by a review of the collected cases and can not be used as an argument for approaching these tumors

from the posterior fossa or through a divided tentorium. Eighty one case records have been found in the literature of pineal tumors the location and limitations of which were given exactly. Sixty two of these tumors did not extend beyond the limits of the third ventricle. Seeding



Fig 5 Postoperative photograph to show site of craniotomy incision and former decompression wound

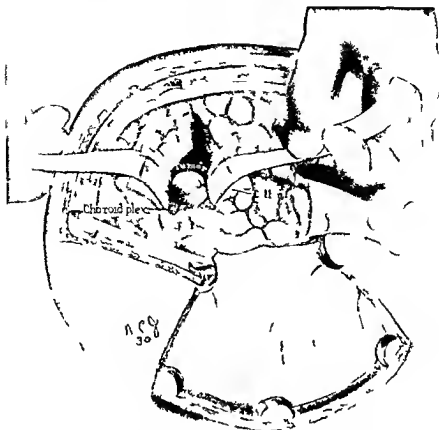


Fig. 3. Epithelial tumor of the choroid plexus of the placenta. (H.C. 308)

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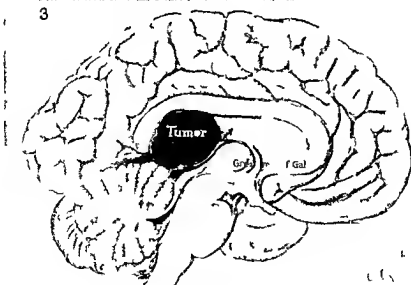


Fig. 3. Sagittal section of the brain showing the tumor. (Gross, f. Gal)

SYPHILIS OF THE INTESTINE

JAIME DE LA GUARDIA M.D. PRESTON CUBA

U. S. D. F. U. S. M. A. Y. Hosp. 11

In discussing syphilis of the stomach Hartwell has stated that a clear cut distinction must be made between lesions of this organ caused by the spirichæta pallida and lesions which arise from other causes in a person suffering from syphilis. The first is a true syphilitic lesion of the stomach the latter is not and must not be confused with the first.

In the present discussion the term syphilis of the stomach is used to indicate a lesion which shows pathological changes similar to those in other tissues caused by the luetic virus. This definition in our opinion applies not only to syphilis of the stomach but to syphilis of the intestine as well and represents the scientific conception of syphilitic lesions of the gastro intestinal tract.

Syphilis of the intestine was first described by Monteggia of Milan in 1794 and later by Cullerier in 1854 Warstat in 1913 and Gaucher in 1916 have written extensive articles on congenital intestinal syphilis while Ceraulo Campana and Schmidt have also written on syphilitic lesions of the intestines, both on congenital and acquired forms. The different phases of the disease have been thoroughly discussed and illustrated with case reports in these articles from the slight enteric manifestation to the less frequent obstructive lesions associated with encircling ulcers and the tendency to stricture formation.

Oberndorfer states that the gastro intestinal tract is infrequently the seat of syphilitic lesions usually gummatous neoplasms.

Brown and Gaither believe that congenital forms of intestinal syphilis obviously occur in early childhood while syphilitic intestinal lesions of acquired syphilis are tertiary and late manifestations of the disease.

McCallum says tertiary lesions of the small intestine are usually localized in the jejunum or the upper ileum where they appear as flat elevations of the character of a syphilitic granulation tissue involving submucosa and mucosa. Multiple ulcers are found which extend in the form of rings around the gut and which in healing may produce strictures. He cites a remarkable example in the Pathological Museum of Colombia University but says the condition must be very rare.

Fraenkel according to Wile states that he has found only 3 cases of intestinal syphilis in 19000

postmortem examinations. He says that in his 5 years experience with luetic patients he has seen no such cases and adds that the jejunum is the more frequent seat of the lesion than any other portion of the intestinal tract.

Sparman remarks that syphilis of the gastro intestinal tract has no characteristic feature unless probably nocturnal exacerbations and calls our attention to the comparative frequency in which cases of supposed malignant disease of the digestive tract have improved under anti luetic treatment.

PATHOLOGY

There are no gross characteristics although Gutmann in reporting a case of multiple ulcers of small intestines of syphilitic origin describes them as circular entirely enclosing the lumen of the bowel with flat basis sharp edges and somewhat undermined. Rieder as quoted by Gutmann gives the following characteristics:

1 The lesions may be situated in any part of the small intestine but are especially frequent in the jejunum.

2 The lesions may be multiple or in separate groups.

3 The lesions have a tendency to encircle the lumen of the bowel.

4 The lesions may cause stenosis.

5 The lesions show uniform consistency.

6 The lesions have nothing to do with the primary ulceration but are a new tissue formation which attacks all the intestinal layers localizing at any early stage around the blood vessels.

Microscopically the principal characteristics are round cell infiltration with epithelioid cells and occasional giant cells. The blood vessels show endarteritis and endophlebitis obliterans some time being completely occluded and there is a perivascular infiltration. Miliary gummata are often seen.

The diagnosis of syphilis of the small intestine is obviously very difficult as the symptoms are not characteristic but vary with the type and location of the lesion. Also as already stated in intestinal symptoms in a person suffering from syphilis do not invariably mean that he has a luetic lesion of the small intestine. Perhaps the most important point to bear in mind in considering a diagnosis of intestinal syphilis is that obstructive symptoms in patients past middle life do

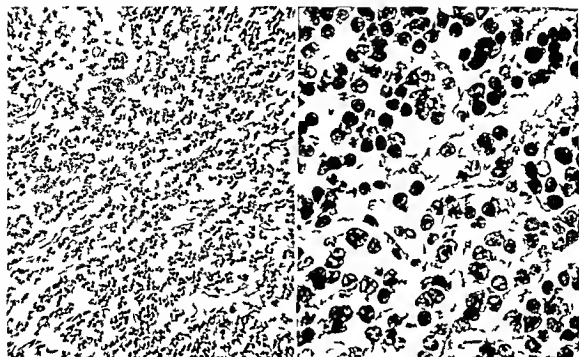


Fig 6 Sect f t me—Mall rys ph sph t g tic d hem to yl st $\times 4$ a d $\times 6$

in the wall of the ventricles in some instances had given rise to multiple tumors. Fifteen extended both into the third ventricle and posteriorly into the Sylvian aqueduct and the region of the superior vermis of the cerebellum. Four were entirely outside of the limits of the third ventricle either in the posterior fossa or in embedded brain tissue.

SUMMARY

The procedure of choice in dealing with tumors of the pineal gland would seem to be first to perform a right subtemporal decompression. This should be followed by intensive deep therapy X-ray or radium radiation until the combination

of these measures no longer seem adequate to alleviate pressure symptoms. At this time an attempt at extirpation of the tumor might well be made. An approach of election would seem to be one through the dilated right lateral ventricle.

A case is reported of a successful extirpation of a pineal gland tumor (spongioblastic type) by the means in a 34 year old woman. She has remained entirely free from symptoms of hydrocephalus for 15 months following operation.

NOTE—I wish to express my thanks to Dr. H. C. H. G. W. kindly effected the patient's clinical observations and I would like to thank Dr. B. H. H. P. for his help.



Fig. 5 Many giant cells under high power. They appear in the submucosa of Figures 1 and 2.



Fig. 6 A similar lesion in another blood vessel. A large giant cell present.

palpated. The other organs were negative. The leucocyte count was 23,000 polymorphonuclears, 75 per cent. Urine was positive for bile and showed a slight trace of albumin.

The patient who was on the medical service showed gradual improvement under treatment. I saw him for the first time on July 25, 1927, a month and 12 days after admission when based on the history the provisional diagnosis of cholelithiasis was made and operation advised.

Operation. Spinal anesthesia was used and the abdomen was opened through a Judd oblique incision. The stomach and duodenum were found to be negative. The gall bladder was slightly distended, somewhat thicker than normal, could be emptied easily on pressure and showed no stones. The cystic and common duct were negative. The head of the pancreas was definitely enlarged, markedly indurated, and was encroaching upon ducts and duodenum. The diagnosis in our opinion lay between a chronic pancreatitis and a malignant condition, and a section of the tumor was excised for pathological examination. The abdomen was closed without drainage and the patient was kept in the hospital until August 12 when he was discharged free of jaundice and feeling much improved. The diagnosis of Dr. Mallory then was chronic pancreatitis.

The patient was readmitted to the hospital June 13, 1928, almost a year after his first admission with the following history:

From January of this year he began to suffer from gastrointestinal disturbances, more or less similar to those experienced a year ago, but with the outstanding symptom of marked feeling of fullness in the stomach, even after a small intake of food. He also noticed a dull, more or less constant pain in the epigastrium with colic-like exacerbations which were only relieved by vomiting self-induced in many occasions. During the 5 days previous to admission he had become so weak that he had to be brought to the hospital by his attending physician. The vomitus had never shown any blood, but was always bile stained.

Physical examination. On admission showed a poorly nourished, anemic, markedly dehydrated adult male. No signs of jaundice were present. Heart sounds were distinct but rapid. Lungs were negative. The pulse rate was 120, respiration 22, temperature 98 degrees F.

The incision of previous operation was soundly healed. No signs of hernia were present. The abdomen was slightly distended. Pain and tenderness could be elicited by pres-

sure over epigastric region. The stomach area was tympanic.

In view of the critical condition of the patient, no further diagnostic procedure was tried, and with the history obtained a provisional diagnosis of upper intestinal obstruction with dilatation of the stomach was made, and the patient treated as follows. The stomach was thoroughly washed out with solution of sodium bicarbonate. It showed marked bile retention and very few particles of food.

One thousand cubic centimeters of 5 per cent saline glucose solution was given intravenously and 1,000 cubic centimeters of the same solution by hypodermoclysis. Murphy drip was instituted with 10 per cent glucose saline solution. Nothing was given by mouth. On August 16 and 17 the same treatment was given, the patient showing marked improvement.

On August 18 X-ray pictures were taken and the following was the radiologist's report:

Stomach markedly dilated, showing practically complete retention 6 and 12 hours after barium meal. Obstruction apparently present at duodenojejunal angle.



Fig. 7 Another lesion within a blood vessel showing several giant cells and no fibrin.



Fig 1 Section of much thickened jejunal mucosa showing typical gummas and in the right half large nodules of small gummas

not necessarily mean cancer in spite of a repeated negative Wassermann. From the surgical standpoint I am going to quote from Riggs who has summarized the subject very satisfactorily

In considering the field of surgery in syphilis of the intestinal tract one appreciates Wilmoth's classification according to symptoms the order of which I am taking the liberty to reverse believing that by so doing the order of clinical frequency is best represented

- 1 Those with nausea vomiting and diarrhoea
- 2 Those with definite digestive disturbances associated with pain and distress
- 3 Those indicating ulcer or stenosis
- 4 Those simulating carcinoma with palpable tumor

It is evident that surgery is rarely if ever necessary or justifiable in the first group but that with



Fig 2 From another section from the same patient showing gummas in the right half of the small intestine and still lower down the upper part of the large intestine

each succeeding group its opportunities for good increase especially if co-ordinated with correct diagnosis and proper treatment

CASE REPORT

J. A. H. C. b. 38 years of age, b. b. r. by cc p. t. u. wa first adm tted t th h spital Jun 4 97 with a history of g. t. o. test. id. tub. ces. h. a. r. t. r. d. by statule. e. a. d. stip. ti. These sympt. ms. had been p. e. t. f. r. the p. t. mo. th. b. c. m. grad. ly. w. e. until 2 d. y. p. i. s. t. dm. whe. h. w. s. 12 d. by a. n. e. cruc. t. g. p. n. r. th. p. g. t. n. c. r. d. t. g. to b. c. k. d. g. h. t. a. h. o. l. d. r. n. d. a. o. c. t. e. d. with n. d. o. m. i. t. t. i. n. g. J. u. d. c. e. p. r. i. t. u. a. d. c. l. y. to l. s. f. l. w. d. th. t. t. a. c. k. Th. f. m. i. l. y. h. i. t. o. r. y. was. e. l. t. Ph. y. c. a. l. m. n. to. h. w. e. d. f. a. i. r. l. y. e. l. d. e. l. p. d. a. d. u. l. t. m. a. l. p. l. y. n. o. u. r. i. s. h. d. w. t. h. c. o. j. c. t. n. d. i. n. d. e. p. l. y. J. d. d. m. a. k. e. d. t. d. e. r. m. a. d. g. d. i. t. y. p. s. e. o. th. h. t. p. p. e. r. q. d. a. t. w. h. m. o. l. d. b. e.



Fig 3 A. m. h. y. l. th. b. m. c. s. c. t. a. n. g. l. g. t. i. l. l.



Fig 4 A. l. g. l. the s. b. m. c. s. a. w. th. the b. f. i. th. right. N. m. e. g. t. c. l. l. p. s. t. d. h. o. h. g. g. e. c. o.

RE-ESTABLISHING THE FLOW OF BILE INTO THE INTESTINAL TRACT

EDMUND HORGAN, M.D. M.Sc. F.A.C.S. WASHINGTON

IN 1881 the same year that Billroth made the first resection of the pylorus his former pupil von Winwarter completed the last stage of an operation to re-establish the flow of bile into the intestinal tract after its normal course had been stopped by an obstruction in the common bile duct.

Since von Winwarter's day a wide variety of conditions which have prevented the flow of bile into the intestine has been observed and recorded. Some of these recorded conditions are congenital atresia of a bile duct, malignant stricture, cicatricial contraction and stricture of a bile duct following healing in obliterative cholangitis, simple ulcer, gall stone ulceration or damage done to a duct wall by a rubber drainage tube, obstruction of a bile duct caused by a stone or an intrinsic tumor, obstruction produced by pressure on a bile duct from an extrinsic tumor, an inflammatory swelling of a neighboring structure or adhesions, traumatic perforation or rupture, and operative trauma such as the accidental division or resection of a bile duct, the ligation or the crushing of a duct, or the excision of a bit of the duct wall.

Many operative methods have been devised to re-establish the flow of bile into the intestine when its natural flow has been arrested by one of these conditions. Von Winwarter in 1881 performed a cholecysto-enterostomy. He found when operating upon a patient that an obstruction in the common bile duct had blocked the normal passage of bile. After several attempts he succeeded in forming an anastomosis between the gall bladder and the jejunum. Ten years later in 1891 Sprengel made the first report of a communication established between a bile duct and the intestine. Sprengel in an operation to relieve a patient of gall stone colic removed the gall bladder and crushed a stone which had lodged at the portal fissure. Bile immediately distended the common bile duct and began seeping through the newly sectioned stump of the cystic duct. To avoid the possibility of an external biliary fistula forming, Sprengel made an incision in the wall of the common bile duct which he sutured to an incision in the duodenum. Bile flowed into the intestine. Riedel in 1888 performed the same operation of direct lateral choledochoduodenostomy but he did not report it until 1892. The earliest recorded case of direct hepaticoduodenostomy was per-

formed by W. J. Mayo in 1904 and reported by him in 1905. When he found the lumen of a common bile duct entirely obliterated he divided the hepatic duct above the obliteration and implanted the stump of the bile duct into an incision in the duodenum. This method of delivering the bile into the intestine proved most satisfactory. The patient on whom the operation was performed lived in good health for many years. W. J. Mayo has perfected the technique of the hepaticoduodenostomy and used it many times with successful results. It has become the method most frequently and satisfactorily employed. In 1905 the same year that W. J. Mayo reported his hepaticoduodenostomy, Kehr (4) in his book

Technik der Gallensteinoperationen recorded a case in which he had performed the same operation in 1902. In 1909 and again in 1912 Sullivan published the results of his experiments on dogs which proved the possibility of epithelization taking place along a canal formed over a rubber drainage tube when the tube bridged a gap between the severed end of a bile duct and an opening in the duodenum and when the exposed portion of the tube was covered over with omentum. Sullivan's work established the indirect method of union in bile duct surgery.

The direct end to end anastomosis of a divided bile duct was first performed by Doyen in 1892. After he had torn a common bile duct transversely when removing a large stone, Doyen united the two ends of the bile duct by circular suture around a short length of rubber drainage tube. Doyen's patient died of hepatic insufficiency a few hours after the operation. This was before healing could take place and before the end result of such an anastomosis could be noted. The direct end to end anastomosis has since been used successfully in numerous instances. The anastomosis usually being made over a rubber catheter or a rubber T tube. An indirect end to end anastomosis was made by Verhoogen in 1907. In order to remove a tumor he excised a portion of the hepatic and common bile ducts. As the patient's condition demanded a quick completion of the operation, Verhoogen made a communication between the bile duct ends by means of a rubber drainage tube. He reported his patient well 3 months after the operation. Indirect end to end anastomosis of a bile duct has occasionally been

- II The end to end anastomosis of a divided bile duct
 - a Direct anastomosis of a divided bile duct
 - b Indirect anastomosis of a divided bile duct
- III The implantation of a biliary fistula into the alimentary tract
 - a Direct implantation of a biliary fistula
 - b Indirect implantation of a biliary fistula
- IV The establishment of a direct communication between the parenchyma of the liver and the alimentary tract (hepatocholelenterostomy)
- V The plastic reconstruction of a portion of the biliary tract
 - a Plastic reconstruction with the use of a pedicle flap or of a transplanted graft
 - b Plastic reconstruction without the use of a pedicle flap or of a transplanted graft
- VI The dilatation of a strictured bile duct

An exhaustive review of the recorded cases in which operation was made to re establish the flow of bile indicates that the principles which have been definitely established are that the reconstructed tract must become lined with epithelium and that it must not contract later to form a stricture. These essentials are best obtained by a simple muco mucous union of the biliary tract with the gastro intestinal tract. Such a union was made in the hepaticoduodenostomy performed by W J Mayo in 1904 and used by him many times since. In his writings he has stressed the importance of the muco mucous union.

The one operation in which a union of the muco membranes has in many instances failed has been in a direct end to end anastomosis of a common bile duct. These failures have not resulted from the muco mucous union which was made but from too much tension being exerted on the tissues when the sutures were pulled tightly in order to approximate the ends of the bile duct. No doubt in these cases so large a segment of the duct was removed that an end to end anastomosis should not have been attempted. In some cases in which an end to end anastomosis has failed a hepaticoduodenostomy has later brought successful results. The reason for the success of a hepaticoduodenostomy is that the duodenum can usually be mobilized and united to the stump of the hepatic duct without tension. In numerous instances in which the duodenum could not be sufficiently mobilized the union has been made with the stomach because of its close anatomical relation with the hepatic duct.



Fig 1 The L shaped rubber catheter for draining the bile ducts. The short fenestrated portion of the tube is designed to lie within the bile duct. The eye at the elbow and the one at the tip of the catheter provide a means of internal drainage of bile when the lumen of the bile duct is unobstructed. The four lateral eyes insure external drainage if the bile duct becomes obstructed.

The lumen of the reconstructed tract must in most instances be kept open by a rubber drainage tube or by some other device until union and the epithelialization of the canal has taken place. The use of a small segment of a rubber drainage tube or catheter which is covered over and allowed to remain in the bile duct is not advisable. If it is not pressed from the duct it will become encrusted with bile salts and obstruct the lumen of the duct, or it will disintegrate and the small particles of rubber will become nuclei for stones which will eventually obstruct the duct. There is one word of caution that should be kept in mind if a T tube is used for this purpose that is it must be left in position for months as Judd has suggested. Its too early removal has sometimes torn the bile duct and the healing of the tear has resulted in the formation of a stricture. In cases in which a removable drainage tube is desirable I advise the use of a removable L-shaped rubber catheter.

The L shaped catheter is of flexible rubber molded with 1/4 inches of the tip bent at a right angle. Sizes 16 and 18 Fr are the ones most generally used. To provide adequate internal and external drainage of bile the catheter is made with six eyes in its short portion which is designed to lie within the bile duct. With an eye placed at the right angle bend and another at the tip bile can flow through freely so that internal drainage can take place when the lumen of the bile duct is unobstructed. Four additional lateral eyes in the short portion of the tube insure external drainage if the lumen of the bile duct be obstructed. This L-shaped catheter can be used for drainage following choledochotomy, dilatation of a stricture of a bile duct, longitudinal incision and reconstruction of a bile duct and end to end anastomosis. The L-shaped catheter can be so securely fastened in a bile duct that drainage can be maintained for many weeks if desired. A chromic catgut suture is used to close the bile duct opening tightly about the tube. The suture is then knotted and the ends wrapped round the stem of the tube. To

employed by others but not always with good results

The earliest attempt to implant a biliary fistula into the gastro intestinal tract was undoubtedly made by Czerny (Merk 8) in 1898. He attempted to relieve a patient of biliary obstruction caused by a carcinoma of the common bile duct near the papilla. Implantation of the fistula did not restore the flow of bile as there was an obstructing metastasis in the hepatic duct. Even though the implanted fistula did not in this instance deliver bile into the intestine Czerny conceived both the idea of implanting a biliary fistula and the technique for carrying out such a procedure. Williams in 1913 was the first one in America to implant a biliary fistula into the intestine. His operation which gave entirely successful results was reported in 1923 by Lahey who at the same time reported an implantation which he himself had made. No large series of operations by this method has been reported. Walters in a personal communication stated that he has implanted a biliary fistula into the stomach or intestine in 5 different cases. In 4 of the 5 cases the functional results were good.

In a few cases when no other procedure was practicable a hepatocholelangoenterostomy has been made by incising the liver and the intestine and anastomosing the two openings in order to get a direct flow of bile from the liver into the intestine. Kehr used this method in 1904. When he found the extrahepatic biliary tract indurated and its lumen obliterated he cut an elliptically shaped piece 6 centimeters long and 2 centimeters broad out of the liver and deepened the hole with a cautery. He then anastomosed the edges of this opening to an opening made in the duodenum. This procedure was done with the idea of making a fistulous communication between the liver and the duodenum in order to have a channel for conveying the bile. Only 4 cases have been recorded in which bile flowed into the intestine following a hepatocholelangoenterostomy. In each case the lumen of the bile ducts was considered to be obliterated. But in at least 2 of these cases there is a question of doubt as to whether the re-establishment of the flow of bile was due to the functioning of the fistulous communication between the liver and the intestine or whether it was due to a re opening of the lumen of the bile ducts.

Von Stubenrauch in 1906 reported a plastic operation on the biliary tract in which reconstruction was accomplished by means of a pedicle flap. He formed a canal for the bile to flow into the gastro-intestinal tract by cutting a flap 6 centimeters long and 2 centimeters wide from the

wall of the stomach turning it backward 180 degrees and suturing its end to an opening in the gall bladder. The new canal was functioning 6 months after the operation when the case was reported. A pedicle flap cut from the gastric or duodenal wall or formed from the atrophied gall bladder or cystic duct has been used in a few cases either to repair a defect in a bile duct wall or to reconstruct the hepatic duct in order to make a hepaticoduodenostomy. Moynihan in 1904 performed the earliest reported plastic operation on a bile duct made without the use of a pedicle flap. He incised a strictured bile duct longitudinally and sutured it transversely to enlarge its lumen. The patient was well 4 years after the operation. In the few reported cases of longitudinal incision and transverse suture the functional results have been excellent. Longitudinal incision and reconstruction over a rubber drainage tube is a method of plastic reconstruction which has been used in a considerable number of cases but rarely with permanently good results. By this method a strictured bile duct is incised longitudinally to enlarge its lumen a rubber drainage tube is placed in the bile duct to maintain the increased caliber of the duct and healing takes place across the gaping or partially sutured edges of the incision. Lejars performed an operation of this kind in 1908. While the immediate result was satisfactory symptoms of obstructive jaundice later developed which necessitated a subsequent operation.

A strictured bile duct has in some cases been dilated sufficiently to re establish the flow of bile. Parkes in 1885 dilated a strictured common bile duct by means of a steel sound which he introduced through a fistulous opening in the gall bladder. Kehr (Volkmar 17) in 1908 succeeded in dilating a contracted portion of a common bile duct by means of a laminaria tent. The following year in another case he (Eichmeyer 2) used a pair of dressing forceps to dilate a stricture in a common bile duct. Since then forceps have been employed for strictures in various parts of the common bile duct including that portion which passes through the head of the pancreas. They have also been used to dilate strictures of the sphincter of Oddi.

There are many different adaptations of these operations. In general however all the methods which have been used to re establish the continuity of the biliary tract with the intestinal tract can be grouped as follows:

- I The implantation of a portion of the biliary tract into the alimentary tract
 - a Direct implantation of the biliary tract
 - b Indirect implantation of the biliary tract

THE SURGICAL TREATMENT OF CARCINOMA OF THE COLON¹

IRRED W. RANKIN, M.D., F.A.C.S., ROCHESTER, MINNESOTA
D. 15 g y The M y C

THE importance of malignancy of the colon as a public health problem is obvious when one recognizes that 10 per cent of all carcinomata which occur in the gastro intestinal tract are in the large intestine or the rectum. Surgical procedures directed toward pathological conditions of the colon unquestionably in the past decade have reached a high plane of technical perfection. They have been put on a satisfactorily comparable basis with the maneuvers which are aimed at the resection or extirpation of other organs of the body.

Recently surgery of the sympathetic nervous system has been directed toward the treatment of megacolon, obstinate constipation and other diseases of the large bowel hitherto considered amenable only to either medical treatment or segmental resection. In the main however all technical maneuvers on the colon are directed toward elimination of malignancy or such inflammatory conditions as diverticulitis or hyperplastic tuberculosis.

With advancing interest in organic conditions of the large bowel and increasing facilities for diagnosis particularly by roentgen rays the recognition of colonic malignancy has been so farwarded in recent years that in the hands of expert roentgenologists at the present time it is comparable to the accuracy with which gastric lesions were formerly diagnosed. Pathologically embryologically and clinically one must recognize the large bowel as a bifunctional organ harboring neoplasms of different types in the two segments and demanding entirely different procedures for their extirpation. Fundamentally one may not attack the right half of the colon by the same methods used in the left half because of the vital differences incident to the function of the two sides and the variety of pathological growths observed.

Infection, obstruction, debilitation, lowered vitality, complications such as distant metastasis, local fixation and formation of abscesses common to lesions of both sides of the colon in the more advanced stages are influences the successful combating of which has changed in large measure the entire scope and prognosis of surgery of the large bowel. At the same time diagnostic measures have been forwardad advantageously.

THE RELATION OF POLYPS TO FORMATION OF CARCINOMA

Etiologically carcinoma continues to be as baffling as it formerly was and carcinoma of the colon is no exception to this generalization. Yet of considerable interest and not indefinite importance is the fact that the relationship of certain commonly found lesions of the large bowel and rectum for instance polyps to formation of carcinoma apparently sheds some light on the cause in a group of cases that is perhaps considerably larger than is suspected. The histogenesis of carcinoma developing on the basis of polyps is a well recognized sequence and in carcinoma of the colon one may trace with espectral accuracy a sequence of events from polyps to malignancy in an unbroken chain. Although I would not advocate the thesis that all carcinomata of the colon or rectum develop on the basis of polyps nevertheless I believe it is easily proved that a large majority of them do. This hypothesis intriguing as it is is not impregnable and although it may be argued with vibrant cogency I question its universal acceptance in view of present day knowledge as to the origin of carcinoma without better confirmation of the stimulating force through which carcinoma is initiated.

In The Mayo Clinic recently in association with FitzGibbon I traced a series of polyps in their change to carcinoma in 13 cases of multiple polyp of the colon 2 of which were instances of generalized involvement of the whole lower bowel. In these 13 cases there appeared 24 definite carcinomata. In of the cases of polyp carcinomata were not found. In the 11 remaining cases there were 24 definite carcinomata 1 of which appeared in 8 cases and one each in the 3 remaining cases. This demonstrates in this series the ratio of multiple to single centers of malignant change in polyp soil as 8:3. Moreover this work confirmed in detail the reports of Hauser, Wechselmann and later of Schmieden and brought the total number of instances in the literature in which the direct sequence has been established to 140.

The term precancerous tissue is always a questionable one to use because carcinomata are relatively speaking never seen except in their fullgrown form. In the lower portion of the colon and in the rectum where carcinoma occurs eight

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by careful physical examination and corroborated by roentgenoscopy (Figs 1 to 7) Since it is impossible to correlate the symptoms and signs of the entire colon as a single organ because of the differences in its two halves two parts should be considered as separate and distinct organs for the particular purpose in hand The right half of the colon to the middle of the transverse segment develops with and parallels functionally the portion of the small bowel which is distal to the papilla of Vater that is its function is absorptive and symptoms referable to it are indicated by disturbances of physiologic function The left half of the large bowel which develops with the rectum from the hindgut is a storehouse absorbing perhaps less than 10 per cent of the fluid content of the gastro intestinal tract and symptoms referable to it revolve around obstructive phenomena

A number of outstanding conditions influence the production of symptoms in the right half of the colon namely (1) the liquid content of this segment (2) the types of pathological growths in this portion which are flat large ulcerating are covered with stubby grayish protuberances and are inclined to occupy the lateral wall of the bowel without producing obstruction and (3) the anatomic consideration of the size of the bowel which here is twice that of its fellow of the opposite side with thinner musculature On the basis of symptomatology cases of carcinoma of the right half of the colon may be divided into three distinct groups which should be considered separately (1) the dyspeptic group usually diagnosed chronic appendicitis or intestinal indigestion (2) the group characterized by anemia and weakness of unexplained origin and (3) the group in which the tumefaction is frequently discovered accidentally or in the course of a routine examination without having previously produced symptoms

Group 1 or the dyspeptic group represents a large number of cases which because of the very uncertainty and indefiniteness of the clinical manifestations frequently is far advanced on being presented for examination Because of this particular group I would emphasize especially the fact that carcinomata of the whole colon in their earlier stages in probably more than 90 per cent of the cases have few pathognomonic symptoms and frequently are evidenced by change of intestinal habit or by intestinal irregularity such as mucous diarrhoea or alternating periods of diarrhoea and constipation The obvious corollary to this is that one should make a thorough investigation of the gastro intestinal tract if

change of intestinal habit or intestinal irregularity persists over a period of say one month In these indefinite cases pain and local tenderness over the caecal area simulating the symptoms of subacute or chronic appendicitis and without a tendency to disappear entirely should call attention to the necessity of a gastro intestinal examination because frequently these may be the earliest symptoms to be found

In the second group characterized by weakness and by anemia without visible loss of blood with out premonitory symptoms one finds a considerable number of right colonic carcinomata This anemia is always unassociated with visible loss of blood and frequently is called to attention by attacks of unexplained weakness or inability to carry on work The anemia may be noted in the course of a routine examination The exact explanation of this type of anemia is not clear but it seems definitely related to some perverted function of the mucous membrane of the large intestine which is impaired to such extent that absorption of toxins results Sometimes the concentration of haemoglobin is as low as 5 or 30 per cent before the patient is forced to undergo a physical examination Usually when such depletion of the blood has occurred however localizing signs are present and the disease is readily diagnosed by the characteristic roentgenogram So often does this picture of anemia occur that I am of the opinion that no patient should receive a diagnosis of primary or secondary anemia until a thorough examination of the entire colon has precluded the possibility of malignancy in its right half It is axiomatic among clinicians that pernicious anemia should always be differentiated from gastric malignancy but I am confident from my own experience that more often it is necessary to exclude carcinoma of the right half of the colon The differential diagnosis is in no wise difficult and may readily be made from the blood picture and the clinical findings

The surprising number of silent carcinomata of the right half of the colon and likewise the high percentage of those that are accidentally discovered is something to which I wish particularly to direct attention In perhaps 10 per cent of cases seen at the clinic either a tumor is discovered by the patient when he least suspects it or in the course of a routine examination for a few intestinal symptoms roentgenologic examination will reveal a filling defect in the caecum I mention this group of cases because of its surprising number and to drive home the importance of a rigid examination by roentgenoscopy not only in cases in which a lesion of the large bowel is

times as frequently as it does throughout the balance of the structure one is able to study earlier deviations from normal tissue because of the accessibility of the region. In addition the presence of large and frequently multiple polyps in this situation offers numerous opportunities to aid in the search for degenerative histological changes. It has long been an established fact that when multiple polyps are scattered throughout the large bowel under different designations such as diffuse polyposis or adenomatosis malignant degenerative changes occur in practically 40 of every 100 cases. The familial tendency to the development of this so called polyposis or adenomatosis is well established and in the records of the clinic we have instances of two families in each of which 5 cases of the disease have been established beyond peradventure. Considering for a moment then multiple polyposis from an etiologic standpoint the classification of the causative factors varies much according to the view or angle of attack of the observer. Not infrequently from the clinical standpoint dysentery ulcerative colitis hyperplastic tuberculosis and non-inflammatory reactions of the large bowel are mentioned as predisposing and exciting causes making easy a grouping along two lines (1) the adult or acquired type and (2) the adolescent congenital type. In demonstrating the degeneration of polyps into malignant growths the classification on the basis of their histological structure is a more logical one which I think in a large number of cases unquestionably proves polyps to be precursors of carcinoma.

In our study of the 13 cases of multiple polyps of the large bowel to establish histological criteria the cases were divided into three groups and the review of the characteristics of polyps demonstrated that they were not all of a piece and that under the name were included precancerous changes through which could be traced definite carcinoma. In group 1 were included only those polyps in which the epithelium retained its normal characteristics. The tumefactions were smooth and regular or roughly nodular in some cases and varied in size from tiny protuberances to masses 2 centimeters or more in diameter on cross section. The matrix of the stalk was the loose connective tissue of the submucosa which expanded to sustain the nodular polyp. There was no tendency to branching or papillary forms. The outstanding characteristic of this group was that there was no indication that the polyps were likely to be affected by whatever stimulus initiates carcinomatous change and that they might be considered benign. In group 2 however the polyps were sharply

distinguishable from those of group 1 by their structural changes in both connective tissue and epithelial elements and were distinctly malignant. Throughout the polyp there was failure to differentiate into the units of normal intestinal mucosa. In the partially differentiated epithelium the cells were elongated and compressed from side to side. Although they might be arranged in single rows in numerous places the compression had piled them into overgrowths of buds which projected into the lumens of the tubules. Likewise the nuclei were elongated. They took stains deeply and this gave to the tissue of proliferation a darker color. FitzGibbon urged that the tempo of the growth is the essential function in the development of malignant polyps. In this group as the epithelial proliferation proceeded there was a response in the connective tissue elements resulting in the piling up of the muscular layer and the submucous layer as well into a stalk. If the tempo was not too brisk these elements were drawn out into branching divisions making tree like supporting scaffold of epithelium. The formation of the pedicle was a matter of epithelial growth in the connective tissue. Sluggishly growing polyps might be greatly influenced by factors outside the tumor particularly by the forces of peristaltic action.

The polyps of group 3 were potentially deep-seated infiltrating carcinomata. In this group were placed those polyps in the epithelium of which the differentiation had stopped so early that the cells were rudimentary and embryonal in type. Group 3 was but a further progression of group 2. Microscopically however the two groups were readily distinguishable. In group 3 the epithelial proliferation was so rapid that the connective tissue was outdistanced and the polyp form consisted of epithelium and tangled skeins of gland tubules. These polyps necessarily because of these histological characteristics were not bulky or sizeable and from them might be traced through their rapid proliferation large ruptures through the muscularis mucosa which would become deep seated infiltrating rapidly growing adenocarcinomata.

These data although not conclusive because of the meager number of cases studied are indubitably confirmatory and stimulating in the search for the initiatory factor which forces the tissue cell into abnormal activity resulting in malignant degenerative changes.

DIAGNOSIS

The diagnosis of lesions of the large bowel is made by a painstaking anamnesis supplemented



FIG. 1. Roentgen ray showing carcinoma in redundant loop of sigmoid.



FIG. 2. Annular carcinoma in the descending colon at the level of the left iliac crest with obstruction.

choice for accurate localization of the filling defect and for precise interpretation of its pathognomonic characteristics.

To epitomize the symptoms of colonic carcinoma the most important early evidences of carcinoma in any portion of the colon are change in intestinal habit as evidenced either by irritability, mucous diarrhoea or alternating periods of diarrhoea and constipation, localized pain and tenderness without a tendency to disappear, tumefaction and profound anaemia not accompanied by loss of blood or if the lesion is in the left half of the colon obstruction of the acute subacute or chronic variety. In the presence of these suggestive phenomena it is imperative that a complete gastro intestinal examination at the hands of an experienced and competent roentgenologist be undertaken and one may feel great assurance that the lesion will be localized. In this connection I would strongly emphasize the fact that the loss of weight, cachexia, dehydration and desiccation so frequently referred to as diagnostic phenomena of carcinoma of the colon are in reality not symptoms of carcinoma at all but are signs of metastasis and impending dissolution.

CO-OPERATIVE MANAGEMENT

It has been a decidedly beneficial factor in many respects in the handling of patients with

colonic lesions in The Mayo Clinic to segregate them in a group under the combined care of clinician and surgeon. This is particularly valuable in the pre-operative management which is instituted routinely and which allows advantage to be taken of all the factors of safety in handling this type of case in an effort to reduce the immediate mortality and at the same time to extend the horizon of operability. These factors of safety are (1) adequate pre-operative rehabilitation combined with necessary decompression (2) selection of the optimal time for operation and selection of an operation for the patient rather than attempting to standardize maneuvers to fit all cases of organic lesions to one or two types of procedure (3) employment of intraperitoneal vaccination with colon bacilli and streptococci as a routine measure in an effort to immunize against peritonitis which is the most common fatal factor (4) employment in a large number of cases of operation in multiple stages (5) selection of spinal anaesthesia in these cases except for very definite contra-indications and (6) rigid adherence to a standardized post-operative regimen. Unquestionably this chain of events has allowed operation to be performed with greater facility in a larger number of cases and with the hope of increasingly satisfactory end results because of the more radical type of

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In the left half of the colon obstructive phenomena dominate the clinical picture. There are obvious reasons for this: (1) pathological growths of this side of the large bowel are inclined to be of an encircling type frequently incorporating the whole lumen of the bowel and causing progressive stenosis; (2) the fecal content of the left half of the colon is hard and formed and with difficulty can be forced through a closing segment. Clinical symptoms depend on the amount of obstruction present when symptoms manifest themselves to the patient. Obstruction is of two types: acute or chronic. There is a small group of persons about 5 per cent of the whole in whom obstruction comes on without premonitory symptoms and is acute and complete from the beginning. This group of cases presents the most difficult and trying experience a surgeon is confronted with in that a potentially fatal acute condition is superimposed on a progressively fatal chronic one. In a group of persons in adult life in whom acute intestinal obstruction is diagnosed if one can by any means determine that the lesion is limited to the large bowel and at the same time can exclude the possibility of strangulated hernia and intussusception the chances are 90 per cent in favor of the lesion causing the stenosis being a carcinoma of the left half of the colon. Relief of this condition is urgently demanded and most frequently is best accomplished by blind caecostomy to be supplemented subsequently by direct attack on the carcinoma after its localization has been made possible by improvement of the patient's condition and subsequent examinations. In the main obstruction is present in the vast majority of cases of carcinoma of the left half of the large bowel in some form or other: acute, subacute or chronic. The subacute and chronic varieties are progressive and manifest themselves either by increasing constipation in elderly persons or by intestinal irregularity and change of intestinal habit. Moynihan's axiom is strikingly true: it reads as follows: "In left colonic growths constipation is the rule while in right colonic growths constipation is rare." This may be supplemented by the aphorism of Rutherford Morrison: "Increasing constipation of recent origin in an elderly person only overcome by purgatives suggests malignant disease of the left half of the large bowel."

Borborygmus and visible peristalsis are frequently noted when the stenosis is progressive and is becoming complete. The borborygmus associated with increased flatulence may be

accounted for by change in the intestinal content or may be due to degeneration of the tumor or to obstructive changes which accompany it. Visualization of peristaltic movement is possible only in lean persons or persons in whom the contraction of the lumen of the bowel produces such obstruction to the fecal current and peristaltic waves to produce proximal dilatation with increased stenosis. The effort of the bowel to force its content through an obstructed lumen may be observed more clearly and occasionally a definite point of stoppage may be accurately indicated by the patient.

There are two symptoms which occasionally are present in left colonic growths and which are comparatively important: namely, melena and tenesmus. Tenesmus is noted in direct ratio to frequency as the growth approaches the rectal sphincter; that is, the lower the growth the greater is the irregularity of the bowel and the more likely is straining at stool to develop. It is an untrustworthy symptom except for rectal carcinoma and may be disregarded as a sign of carcinoma of the colon proximal to the middle of the sigmoid. Blood in the stool or on the stool on the other hand is the most frequent symptom of left-sided growths or upper rectal growths. Little confidence is to be placed in the presence or absence of occult blood in the stools as a diagnostic measure. If the blood is bright red if it is in the stool or on it and if it persists on repeated examinations unquestionably there is a lesion distal to the splenic flexure of the colon. Blood is rarely discovered when the growth is in the right side of the colon even by the more delicate tests for occult blood.

Of greatest importance in the diagnosis of colonic malignancy has been the advancement of roentgenologic technique to the present point of accuracy; it is now possible to parallel the information that has been obtainable for a decade or more in lesions of the stomach and duodenum. The characteristic roentgenologic evidence of malignant disease in the large bowel is so accurate that in 102 cases of carcinoma of the colon beyond the transverse segment proved at operation at The Mayo Clinic in 1929 error in examination was made in only 3 cases. A filling defect or visualized interference with the integrity of the lumen of the bowel is so pronounced in the majority of instances in which accurate preparation has been made that experience with the fluoroscope promises to continue this accuracy. The barium clyster roentgenologically controlled aided by palpatory manipulation and verification of the results by roentgenography is the method of



Fig. 1. Roentgen ray showing carcinoma in redundant loop of sigmoid.



Fig. 2. Annular carcinoma in the descending colon at the level of the left iliac crest with obstruction.

choice for accurate localization of the filling defect and for precise interpretation of its pathognomonic characteristics.

To epitomize the symptoms of colonic carcinoma the most important early evidences of carcinoma in any portion of the colon are change in intestinal habit as evidenced either by irritability, mucous diarrhoea or alternating periods of diarrhoea and constipation, localized pain and tenderness without a tendency to disappear, tumefaction, and profound anemia not accompanied by loss of blood or if the lesion is in the left half of the colon obstruction of the acute, subacute or chronic variety. In the presence of these suggestive phenomena it is imperative that a complete gastro-intestinal examination at the hands of an experienced and competent roentgenologist be undertaken and one may feel great assurance that the lesion will be localized. In this connection I would strongly emphasize the fact that the loss of weight, cachexia, dehydration and desiccation so frequently referred to as diagnostic phenomena of carcinoma of the colon are in reality not symptoms of carcinoma at all but are signs of metastasis and impending dissolution.

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Fig. 5 Annular carcinoma of the descending colon just above the level of the left iliac crest



Fig. 6 Filling defect in distal part of ascending colon near the hepatic flexure. Carcinoma

expressing any arbitrary opinion and in the belief that each surgeon should select that anæsthetic which he personally feels is most satisfactory for this type of case. I have had a most favorable experience in a large series of cases by the use of spinal anæsthesia. The comfort of operating, the bloodlessness of the operative field and the postoperative freedom from peristalsis for 36 hours are very well known advantages which are appealing. On the other hand I do not believe it is possible to employ spinal anæsthesia routinely without narrowing the margin of safety over inhalatory methods and yet in the evaluation of the advantages over the disadvantages in this type of anæsthesia my personal experience has been in its favor. Certainly common sense should govern the selection of anæsthesia in every field of surgery and it is unquestionably true that there has been no single anæsthetic yet developed which is satisfactory in all surgical fields. Each has definite indications and contra indications and in the end the choice is based on personal selection by the surgeon. I do not believe that spinal anæsthesia should ever be given by anyone other than a highly skilled and expert anæsthetist and that he during the operation and subsequent to it should maintain a watchful eye on the patient for evidences of falling blood pressure or other complications. In the

event that it is properly given and supervised I subscribe that the danger incident to its employment is reduced to a minimum and in our experience in the last 3 years in which we have used it routinely we have had no untoward immediate effects.

CHOICE OF OPERATION

Several factors influence the choice of operation in the two halves of the colon. The matter of graded operations on either side however is of greatest importance. In the right half of the colon it is my feeling that aseptic ileocolostomy between the terminal ileum and the transverse colon followed by resection of the right segment at the same stage or a subsequent one is the procedure of choice. I urge the employment of end-to-side anastomosis rather than lateral anastomosis in this particular instance because of the very desirable feature which the end-to-side method possesses over the lateral in side tracking the faecal current and allowing as much reduction of local inflammatory reaction around the growth as is possible. At the time when this anastomosis is made and I prefer an aseptic type, one may decide whether to do the resection making the operation complete in one stage or to abandon the procedure and extirpate at a subsequent stage the segment which harbors the neoplasm. This is a decision which must be made at the operating



Fig 3 R t g n a y h o w c c o m a of the m d d l th d f the s g m o d



Fig 4 C r c m a of th t r a n s c l th a r a t h t d i c t j t d i s t a l t h p t f l u x e

surgical procedure employed. It should be remembered that the standard of efficiency in extirpation of colonic growths is in the hands of the average operator, the percentage of operability rather than the percentage of mortality and to increase the operability and at the same time reduce the mortality measures of rehabilitation and decompression are the most essential factors to be observed.

A great many of these patients perhaps the majority of them on admission are in a state of lowered resistance they frequently are dehydrated and desiccated as a result of obstruction and its concomitant toxæmia and of lowering of the physiologic equilibrium. To increase the general resistance of the patient dietary and rehabilitary measures are combined with attempts at decompression over a sufficiently long period to reduce as far as possible the infection around the growth and the obstruction caused by the growth. Frequently blood transfusions are indicated and insistence on a large intake of fluid and a high caloric diet are necessary. Twenty per cent fruit juices, candy, rice, butter, eggs and so forth low in residue and high in food value are urged. At the same time decompression is attempted by constant rectal irrigations with warm saline solutions supplemented by

mild purgation with the fluid extract of senna. The irrigations not only tend to reduce the intra colonic pressure but in rectal and left sided colonic growths have an important influence on the reduction of infection in and surrounding the growth. Although the vast majority of left colonic carcinomata cause some type of obstruction by these means in about 80 or 90 per cent of the cases it is possible to reduce obstruction even of the subacute or acute variety to a point at which the bowel is flat and satisfactory for segmental resection at the time of operation.

By using intraperitoneal vaccine of streptococci and colon bacilli prepared from patients who have succumbed to peritonitis I am confident that the percentage of fatal peritonitis has been reduced materially. Routinely this is employed before operation being given 3 days before resection. It is a theoretically correct procedure is undoubtedly one of the most important steps in the pre operative management and has unquestionably contributed to the increasingly good results. It has been employed in more than 500 cases and its advantages are considered as established.

One consideration which I offer with some hesitation is that of the routine employment of spinal anesthesia in these colonic cases. Without

on the other hand as happens in the majority of cases the obstruction is mild and has been largely relieved by pre operative decompression resection frequently may be accomplished in one stage but without anastomosis I do not believe that primary anastomosis should be carried out in the left colon except in extremely rare instances and when it is carried out I think a decompression procedure proximal to it by cecostomy is always indicated In the average case in a mobile segment of bowel and this means from the hepatic flexure to the middle of the sigmoid I believe the procedures of choice are (1) obstructive resection and (2) a drainage operation followed by resection and anastomosis in two stages

Obstructive resection combines the desirable features of the old type of Mikulicz operation in one stage making it a radical operation removing the growth and leaving the bowel obstructed for a period of 48 to 72 hours I have employed it in a large series of cases with a mortality rate of about 5 per cent and its desirable features have been increasingly borne in on me as I have extended the series The Mikulicz procedure was a local resection accompanied by high mortality when a large series of cases was considered At the same time it resulted in recurrence of the growth in the abdominal wall in 12 per cent of the cases with the possibility of a higher percentage of intra abdominal malignant lesions recurring because of failure to do widespread block dissection of the gland bearing tissues in juxtaposition to the growth Obstructive resection obviates these disadvantages makes possible radical excision of gland bearing tissues with the growth and in my experience has resulted in huge lowering of the mortality rate

The mobilization of mobile or mobilizable segments of the large bowel down to the middle of the sigmoid is accomplished easily by division of the outer leaf of the peritoneum which is bloodless and by rotating the bowel mesially wiping the glands and the fat of the mesentery inward The blood supply is ligated close to the root of the mesentery and as large a block of tissue as is feasible is removed The clamp is left closed for 48 hours at least preferably for 60 to 72 hours and then the proximal blade is opened allowing the gas to escape which it does if there is intra colonic pressure The clamp is allowed to remain on the distal portion falling off when it necroses through about the seventh or eighth day This leaves the two blind gun barrels much as in the old type of operation When the spur of this is cut out by an enterotome complete healing takes place spontaneously in a high percentage of cases

(about half in my series) if the mucous membrane is not attached to the cutaneous margins and everted and if sufficient time is allowed before attempt at closure of the colostomy opening is made This time customarily is around 6 weeks to 2 months and in any event the longer one waits before attempting closure of the colostomy opening to allow regression of the inflammatory tissue the more likely is closure to be successful at the initial attempt This type of operation of course never can be undertaken in the face of any type of obstruction and in the event of obstruction one must have at hand other stratagems which necessarily consist of decompression operations followed by resection and anastomosis The obstructive type of operation therefore may frequently be done in one stage whereas the other is necessarily an operation in multiple stages

MORTALITY

Mortality statistics in surgery of the colon and rectum have fortunately been slightly revised downward in the course of the past decade and yet they continue relatively high in comparison with mortality statistics for other chronic ailments of the gastro intestinal tract Many reasons are perfectly obvious for this discrepancy which however is more apparent than real I mean that the organic lesions of the large bowel which necessitate surgical attack on it are not only of a serious but also of a complicated nature and the very type of structure which they affect adds difficulties rather than encouragements The infection in and around growths the uncertainty of the blood supply the distribution of lymphatic structures and the technical difficulties incident to mobilization and resection are well known to all Nevertheless a note of encouragement is present and this should I think be given prominence by surgeons rather than the hitherto somewhat widespread pessimism that has attended surgery of this particular region The end results following successful extirpation of colonic and rectal growths are not only comparable to but superior to the ultimate end results of surgical attacks on malignant growths of the balance of the gastro intestinal tract I think that this statement is readily proved by comparison of statistical data from the clinics of various surgeons throughout the world An accepted mortality rate of about 10 per cent is in our hands at the clinic felt to be not unreasonable W J Mayo many years ago uttered the dictum that to decrease the mortality rate below this figure laid one liable to the accusation that many patients who might be benefited were being refused surgical help In other words,



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table in each case on its own merits and few rules can be laid down otherwise. In my own experience I have passed through several stages in relation to resection of the right half of the colon ranging from complete resection and anastomosis in one stage with decompression by ileostomy in the terminal ileum to a routine plan of ileocolostomy and subsequent resection in two stages. Recently I have found that in about half of the cases one may just as satisfactorily accomplish the operation in one stage as in two with the same mortality rate and yet I am confident that this maneuver should be reserved for the patients who constitute sturdier risks who are not depleted and whose general resistance is capable of combating a formidable surgical procedure. After the anastomosis has been made in the event one decides to do an operation in two stages the second stage is readily accomplished and is very simple. It consists in mobilizing the colon dividing it and turning in the cut ends. The question of decompression after ileocolostomy is one that has received much consideration and when decompression is needed it provides a highly desirable safety valve. One may do either an ileostomy of the Witzel type in the terminal ileum proximal to the anastomosis or after resection of the colon and turning in the cut ends

by a purse string suture one may leave the catgut long bringing it out through the end of the wound and leaving it as a guide down which one may spear with a forceps on the fourth day if intra colonic pressure increases and untoward symptoms develop. Should it be advantageous to postpone the second stage of the operation for a time experience is convincing that the interval should be considerable. The urgent desire to complete an operation in one stage should not influence surgical judgment if by delay even though it may be long continued one may without death of the patient remove the segment. The economic situation always urges that the operation be done as quickly as possible and yet one's judgment should not be influenced by economics in dealing with carcinoma for radical measures are the only measures worth while and to dally with a carcinoma or to attack it indecisively is futile.

The matter of exploration of the abdomen before deciding on any type of operation in any portion of the colon is important. It should be carried out routinely. I think in about the following order: (1) the liver (2) the aortic glands (3) the glands at the bifurcation of the mesenteric vessels (4) the pelvis and (5) the growth and its adjacent lymphatic structures. The important point to be observed in this exploration is that the growth be palpated last and that its palpation then should be done gingerly and gently. The information one obtains from palpation of the growth concerns (1) complications such as formation of abscess (2) its extent (3) its mobility and (4) the presence or absence of enlarged lymphatic structures in the vicinity which may or may not be malignant. A determination possible only by microscopic examination. Gentleness is essential since should a complication such as an abscess be present one may very easily and unsuspectingly insert a finger into the abscess. This will make another complication which will force resection at an undesirable moment. Likewise as is easily demonstrated infection is spread from the primary growth throughout the peritoneal cavity by the examining hand because of the number and the virulence of organisms in and around the growth.

In the left half of the colon where obstruction is the most alarming symptom the problem is different from that presented in the right half even to the anatomical type of bowel which is to be operated on. If the obstruction is acute and the bowel is dilated edematous and filled with material drainage by caecostomy or colostomy proximal to the growth is urgently indicated. If

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Obstructive resection combines the desirable features of the old type of Mikulicz operation in one stage making it a radical operation removing the growth and leaving the bowel obstructed for a period of 48 to 72 hours. I have employed it in a large series of cases with a mortality rate of about 5 per cent and its desirable features have been increasingly borne in on me as I have extended the series. The Mikulicz procedure was a local resection accompanied by high mortality when a large series of cases was considered. At the same time it resulted in recurrence of the growth in the abdominal wall in 12 per cent of the cases with the possibility of a higher percentage of intra abdominal malignant lesions recurring because of failure to do widespread block dissection of the gland bearing tissues in juxtaposition to the growth. Obstructive resection obviates these disadvantages makes possible radical excision of gland bearing tissues with the growth and in my experience has resulted in huge lowering of the mortality rate.

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(about half in my series) if the mucous membrane is not attached to the cutaneous margins and everted and if sufficient time is allowed before attempt at closure of the colostomy opening is made This time customarily is around 6 weeks to months and in any event the longer one waits before attempting closure of the colostomy opening to allow regression of the inflammatory tissue the more likely is closure to be successful at the initial attempt This type of operation of course never can be undertaken in the face of any type of obstruction and in the event of obstruction one must have at hand other stratagems which necessarily consist of decompression operations followed by resection and anastomosis The obstructive type of operation therefore may frequently be done in one stage whereas the other is necessarily an operation in multiple stages

MORTALITY

Mortality statistics in surgery of the colon and rectum have fortunately been slightly revised downward in the course of the past decade and yet they continue relatively high in comparison with mortality statistics for other chronic ailments of the gastro intestinal tract Many reasons are perfectly obvious for this discrepancy which however is more apparent than real I mean that the organic lesions of the large bowel which necessitate surgical attack on it are not only of a serious but also of a complicated nature and the very type of structure which they affect adds difficulties rather than encouragements The infection in and around growths the uncertainty of the blood supply the distribution of lymphatic structures and the technical difficulties incident to mobilization and resection are well known to all Nevertheless a note of encouragement is present and this should I think be given prominence by surgeons rather than the hitherto somewhat widespread pessimism that has attended surgery of this particular region The end results following successful extirpation of colonic and rectal growths are not only comparable to but superior to the ultimate end results of surgical attacks on malignant growths of the balance of the gastro intestinal tract I think that this statement is readily proved by comparison of statistical data from the clinics of various surgeons throughout the world An accepted mortality rate of 10 to 20 per cent is in our hands at the clinic felt to be not unreasonable W J Mayo many years ago uttered the dictum that to decrease the mortality rate below this figure laid one liable to the accusation that many patients who might be benefited were being refused surgical help In other words

the operability of carcinoma of the colon and rectum should be the deciding factor rather than the immediate mortality rate

In The Mayo Clinic in 1929 the operability rate in our series was 57.5 per cent. Operability unquestionably differs in the hands of different surgeons and is largely a matter of individual judgment. Judgment obviously should always be tempered with discretion and yet lack of courage in dealing with diseases of the large bowel condemns many patients to early death by refusal of an attempt to extirpate the growth. The horizon of operability must not be narrowed to such an extent that the rate of immediate mortality is too satisfactory for if this is done fewer persons out of a given hundred will be alive and free from recurrence at the end of 5 years than if a higher mortality rate from the immediate operation had been accepted. The two segments of the colon above the rectosigmoid have been subject to increasingly satisfactory attack by operation under co-operative management of surgeon and internist and individualization and segregation of the patients which permit of selective stratagems. Of the first segment which includes the terminal part of the ileum the cæcum ascending colon hepatic flexure and transverse colon around to its middle namely that portion developed from the midgut in 1929 at The Mayo Clinic there were 160 operations with 14 deaths a mortality rate of 8.7 per cent. These operations were for organic disease of the large bowel carcinoma in the large majority of instances and in addition

for hyperplastic tuberculosis and repair of chronic faecal fistulas. I have not been impressed with the utility of operations for prolapse of the colon and other plastic operations aimed at the relief of so-called stasis and allied complaints and I have never been guilty of the performance of any operation for this type of ailment.

On the left half of the colon which is considered that part which runs from the middle of the transverse colon down to the rectosigmoid there were 227 operations with 17 deaths a mortality rate of 7.4 per cent. In recent years the increasing use of obstructive resection which is largely a one stage operation has reduced the number of operations in this particular portion of the large bowel and the mortality rate represents practically a mortality figured on the basis of number of patients rather than on the basis of number of operations.

The improvement in diagnostic methods then particularly in roentgenoscopy and proctoscopy permitting earlier recognition of lesions of the large bowel and rectum together with emphasis on the importance of more routine examinations particularly after the development of the earlier symptoms of intestinal dyscrasias or as a part of the routine yearly examination will bring this group of people to examination and operation at an earlier time. These measures will undoubtedly increase the operable group to more favorable proportions and at the same time will offer much more reasonable hope for a satisfactory end result.

VERTICAL SKIN-GRAFTS FOR RECONSTRUCTION OF EYEBROWS

STIRLING BUNNELL M.D. SAN FRANCISCO

THE peculiar appearance resulting from loss of eyebrows is so conspicuous and conducive to mental suffering that reconstruction of them is often imperative. The improvement in appearance is striking.

Eyebrows have been made by using pedicle grafts of the scalp but this requires extensive and somewhat disfiguring operations. Thiersch grafts do not convey hair. Wolfe grafts convey hair but if from the scalp the thickness is so great that due to necrosis only about one fourth of the hairs survive. In full thickness grafts of the scalp the mass of tissue is too great to be vascularized before partial necrosis sets in. An eyebrow is one third of an inch wide and hair follicles in the scalp extend one fourth inch below the surface. Therefore a strip of Wolfe graft of such bulk would probably not live and even if its outer zone should survive only a few hairs would live in the presence of the central sloughing.

As the cutting of the skin graft in the usual way in a plane parallel with the surface of the skin would necessitate too great a thickness for the graft to survive I cut a thin vertical slice from the scalp and implant it along the brow vertical to the surface of the skin. The process can be repeated three or four times at intervals of a month each slice being implanted above the last until the eyebrow is of sufficient breadth. Each

successive slice is made shorter at its outer end so the eyebrow will be thicker in its medial third and taper laterally. In the inner fourth of the eyebrow the implants are made somewhat slanting to the surface. Each vertical slice is as thin as a millimeter and a half and is contacted with vascular tissue on each side so its vitality is assured. In a month it is sufficiently vascular to nourish the adjoining side of the next slice implanted beside it. The technique is as follows.

Three Bard Parker scalpel blades with between them two strips of sheet metal (each a millimeter and a half in thickness) are clamped together by two Mayo hemostats. The three blades are thus held parallel and each a millimeter and a half apart and the two hemostats are grasped together as a handle.

An area of scalp in the midoccipital region which is the last part to become bald is shaved and painted with 50 per cent tincture of iodine. With one vertical stroke of the tri-bladed scalpel down the midline of the scalp in the direction of the hair two equal slices of graft are cut. A deep incision is then made along the line of each eyebrow and the slices of scalp are implanted in these and secured in place with fine sutures. The upper ends of the graft should be medial so the hairs will point laterally. Each stitch catches one edge of the incision; passes through the graft



Fig 1



Fig 2



Fig 3

Fig 1 Case G. D. Appearance of patient March 4 1929 before reconstruction. Regions of eyebrows scalp and face have been Thiersch grafted. Most of each eyebrow has been destroyed. There are also contracting cicatrices of face defect in upper lids defect in right alar nas and deflection of nose.

Fig 2 The first slice of vertical hair bearing skin graft has been placed in the line of each eyebrow. Also upper eyelids have been partially reconstructed by epithelial inlays.

Fig 3 Three bladed scalpel for cutting equal slices of vertical skin grafts made by clamping together three Bard Parker blades with strips of sheet metal between



Fig 4



Fig 5



Fig 5A

Fig 4 Septemb 1939 Eyebrows partially continued. Added to slices of thick graft added to the skin being grafted from the scalp. The grafts were placed in the scalp and the eyebrows were grafted.

Fig 5 June 27 1933 The eyebrows were partially grafted. New skin was supplied to eyelids and nose. The grafts were placed in the scalp and the eyebrows were grafted. Also a piece of skin was grafted to the eyebrows.



Fig 6



Fig 7



Fig 8

Fig 6 C G M D mb 5 1933 Appraiser followed the eyebrows. The grafts were placed in the scalp and the eyebrows were grafted. The grafts were placed in the scalp and the eyebrows were grafted.

Fig 7 The eyebrows were grafted. The grafts were placed in the scalp and the eyebrows were grafted. The grafts were placed in the scalp and the eyebrows were grafted.

just beneath the surface and emerges catching the other edge of the incision. The wound in the scalp is closed until the next slice is to be added. The procedure can be done in an office under local anesthesia.

The grafts take with a surety and in the several cases in which I have used them apparently

every hair lives and thrives. At first the new growth of hair is thin and brittle but a few months later becomes healthy and strong.

In each of the cases pictured in this report the eyebrows were lost from third degree burns. The improvement in appearance by the acquisition of eyebrows was marked.

PRINCIPLES AND TECHNIQUE INVOLVED IN THE PRESENT DAY TREATMENT OF CANCER OF THE UTERINE CERVIX

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THE micromechanics of healthy epithelium in the generative tract have been considered elsewhere in connection with the way in which the diseased epithelium responds in cancer of the uterine cervix. The present study has to do with the reaction of cancerous epithelium of the cervix to therapy, particularly toward radiotherapy. By ascertaining the reasons for failures in technique, certain principles can be established which are basic in treating cervical cancer and lead up to standardization as far as the individuality of the problem will permit.

It is now a surgical platitude that no operation deserves to be considered in cancer of the uterine cervix unless it includes the outlying extension and metastatic deposits together with the primary growth. Incomplete procedures only disseminate the tumor and create a situation which makes it more inaccessible to radiation. In the light of what is known about extension and regional drainage in malignant growths of the cervix, simple panhysterectomy must be discarded as an insufficient measure.

Initial steps in an extended operation consist in the demonstration and isolation of the ureters in their course through the broad ligaments to the base of the bladder. In addition to the removal of the uterus and adnexa, the technique entails an excision of the parametrium close to the pelvic wall and the resection of the vagina at least 5 centimeters beyond the growth.

There is no question that the extended or radical operation is of major character and the immediate mortality is high. According to Lynch among 3,239 patients who were subjected to operation by various surgeons there were 534 operative deaths. This amounts to 16.5 per cent and means that about one sixth of the patients do not survive the operation.

On the other hand of this surgical series 1,313 patients or 40.5 per cent remained clinically well after 5 years. In comparison with this of 646 patients who were treated solely by radiotherapy 236 that is 36.5 per cent could be recorded as 5 year cures. In some of the individual groups a decidedly higher percentage is attained.

It is difficult to correlate statistics from various sources because of the great personal equation that enters into the classification of patients according to the clinical stage of the growth. As a

fair average it might be said in round numbers that the 5 year cures which have been obtained by radiotherapy amount to about 36 per cent in operable, 6 per cent in borderline and 16 per cent in advanced cases.

This shows that although the results with radiological methods in very early carcinoma so far have not surpassed those of surgery, the scope of radiotherapy is greater. More than this it lends itself to the treatment of those advanced growths in which 5 year cures are no longer attainable by any means and holds out the hope that the span of life may be prolonged and often doubled.

In borderline cases in which the degree of invasion of the cellular tissue of the *doublet space* between the broad and sacro uterine ligaments always remains somewhat uncertain, radiotherapy is unquestionably preferable to surgery because of the lesser risk and greater promise.

In the early cases which belong to the truly operable class it is the fact that the mortality after operation is so high rather than the guarantee of a better result that may be determining. However, exceptionally in small epitheliomata of the cervix in lean women who also are otherwise surgically fit, operation may still be considered justifiable in the hands of surgeons who are thoroughly experienced in pelvic technique. At least under these circumstances surgery leaves very little doubt that any cancer nests in the vicinity of the growth have escaped the therapy. The fact remains that there are instances of comparatively early carcinoma of the cervix in which radium treatment combined with high voltage therapy has failed to achieve a 5 year cure. But it cannot escape those who are working in this field that the technique is still capable of much improvement and that perhaps after all the question is purely one of adequate radiation. At least two instances can be recalled at the Cancer Institute in which this criticism is unmistakably tenable.

A vital problem has been how to secure the uniform, not the focal, destruction of cancer cells; another problem, the sufficient radiation not only of the primary growth but also of its more inaccessible outlying parts. An early recurrence locally probably signifies that some malignant areas have been allowed to remain in the cancerous

cervix while later recurrence usually means that the outposts of the cancer have been insufficiently treated. Further study is necessary which correlates the exact anatomical location of the recurrence with the special technique employed in particular cases.

It is a little more than two decades since the first attempts were made to use radium in tumor therapy. Robert Abbe in this city probably was the first surgeon to apply it to uterine cancer. There are some who will recall the practical inconvenience of carrying about small quantities of this precious substance from one sufferer to the other.

Then there was found a way of collecting from radium the emanation on which its radioactivity depends. Instead of applying the radium itself measured quantities of the gaseous emanation were available in glass capillaries which were then enclosed in small capsules or applicators. This made it possible to treat many tumors at once with the emanation that was obtained from an otherwise limited supply of radium. The physical and chemical effects in broad terms are the same as for the radium salt itself which has first to produce emanation before this can resolve itself further to liberate radiant energy.

The radium emanation or radon yields α , β and γ rays. The α rays do not penetrate tissue and have no therapeutic value. Only the β and γ rays have been applicable to cancer.

After the emanation or radon has been collected in sealed glass capillaries the α ray is with held but the β and γ rays are available. When the capillaries are placed in a metal container of sufficient wall thickness for screenage the primary β rays cannot escape and the γ rays alone pass through the filter. In this way relatively pure γ ray activity is obtained.

One millimeter of lead is capable of absorbing 99.9 per cent of the primary β rays. The value of other metals as filters in comparison with lead depends directly on their relative density. On this basis to obtain equivalent β ray screenage the capsule wall thickness must vary according to the metal of which it consists: platinum 0.5 millimeter and gold 0.6 millimeter; silver or lead 1.0 millimeter; steel or brass 2.0 millimeters; aluminum 4.0 millimeters.

Thus one half the thickness of platinum suffices to give about the same filtration as lead. Because of the lesser wall thickness which is required capsules that are less bulky can be constructed by using platinum without in any way reducing the screenage.

Theoretically the small fraction of 1 per cent of β rays that escapes with this screenage to-

gether with some of the other soft γ ray components seems negligible but practically it is not.

No real disadvantage can accrue from using ampler screenage with platinum since no more than a 2 millimeter wall thickness is probably ever necessary to insure satisfactory filtration. This still permits the construction of a capsule which is not too large for intra uterine as well as extra uterine application.

With this added filtration however the increased absorption of γ rays by the metal becomes a factor. In determining the quantity of the radium salt or its emanation that each applicator shall contain an allowance must be made on account of the loss of available γ ray activity which is due to this absorption. According to figures obtained from S. Schneiderman 0.5 millimeter of platinum absorbs 4.90 per cent or about one twentieth of the γ rays while 1.0 millimeter of platinum takes up 9.56 per cent that is nearly one tenth and with 2.0 millimeters of this metal the absorption rises to 18.4 per cent or almost one fifth.

In other words if 50 millicuries is intended to be the available working dose then the initial dose in the capsule must be one twentieth greater when the platinum capsule is one half millimeter thick; therefore 5.5 millicuries one tenth more when the filter is 1.0 millimeter thick; that is 5.5 millicuries and nearly one fifth must be added for the standard platinum capsule of 2 millimeter wall thickness namely 10 millicuries making the initial dose 60 millicuries in order to obtain an available working dose of 50 millicuries.

Perhaps partly because the uterus forms a naturally well adapted receptacle for the radium applicator the outstanding work with radium on cancer has been done in gynecology. It is fortuitous that this has been so since carcinoma of the uterine cervix has proved to be particularly difficult to approach by surgery.

Clinically speaking the average cancer of the cervix includes about 36 cubic centimeters of primary tumor bed. If 0.9 to 1.0 millicurie must be delivered as a lethal dose to each cubic centimeter of this tissue then a total dosage of 4,300 to 4,800 millicurie hours will be required solely to destroy the zone from which the tumor grows. This dosage does not include that which shall be necessary to reach the extensions of the primary growth into outlying districts and its secondary deposits along the anatomic lines of the regional drainage.

It has become evident in practice that by seed implantation alone this requirement is not adequately met. When glass seeds were used with a

potency varying from a minimum of 0.3 millicurie to a maximum of 0.5 millicurie each at least two or three of these seeds had to be allotted to each cubic centimeter of tissue in the periphery of the tumor. Although no radiation was wasted on the exophytic and decadent portions of the growth nevertheless in order to escape traumatizing the cancer bed itself too extensively by numerous implantations instead of two or three seeds actually seldom more than one seed to the cubic centimeter was used. This means that at one session the tumor received directly only about one half or one third of the dosage which it should have had. With the idea of making good this shortage the procedure was repeated once or twice after an interval of 3 to 6 weeks. In some instances instead of the vaginal the transperitoneal route was chosen.

However the great importance of the time span through which the dosage is distributed became apparent with the experience that in spite of the usual co-ordination of the treatment with high voltage some portions of the primary growth remained active reasserted themselves and gradually made headway, as it were, over the radiation or escaped beyond its control.

Seed implantation alone, therefore, without reinforcement, is too feeble for the needs in dealing with cervical cancer. While the total initial dose is insufficient and further dosage must follow it takes nearly 4 days before one half of the initial dosage is spent upon the tissues so that it may become effective and not before the end of one month has all the radiant energy been dispensed. There can be little doubt that as time elapses under incomplete radiation some parts of the primary mass will continue to grow. *In order to prevent the cancer from becoming uncontrollable the lethal dose must be given as rapidly as the radiated tissues and structures will permit.*

Another inadequacy in the therapy by means of radon seeds is referable to the production of what may be called barrier sclerosis before the invading carcinoma is completely destroyed. Microscopical sections of the shrunken cervix after this treatment not infrequently show a massive mesh of altered connective tissue in which groups of dormant cancer cells are imprisoned that subsequently may become active. Sometimes the site of the tumor appears healed clinically when in a later follow up examination a cancerous patch is discovered which has broken through the sclerosed surface. All this reveals that the destruction of cancer cells instead of having been uniform has occurred in scattered areas and is focal in character. These minute groups of cancer cells

cannot be localized clinically and any degree of precision in the implantation of seeds is no longer possible. Besides this the sclerosis barrier makes the situation more difficult to deal with no matter what method of radiation is subsequently chosen.

It is primarily the catalysis of the cancer cells that is wanted and not so much their incarceration in connective tissue. The primary β ray emitted by the unscreened glass seed is without question largely responsible for inciting excessive sclerosis before all the cancerous elements have been reached.

The tissue damage caused by the implantation trocar calls for replacement by connective tissue. The seeds which remain imbedded in the tumor are minute foreign bodies and as such play a part by mechanical irritation. But these factors are minimal when compared with the irritant action upon the environment of the implant by the escaping β rays. There is necrosis with the seed as its center and in the surrounding connective tissue both replacement reaction and defensive response. These changes however are not far reaching but limited to a small radius; they are focal because the β ray does not penetrate but is absorbed in the tissues of the tumor within a few millimeters of its source.

There is no question about the effectiveness of the primary β ray in the immediate vicinity of the seed but the problem is the effacement of the doubtful areas which lie beyond the short range of the seed. If the β rays could be evenly distributed to every part of the tumor then the therapeutic result would be perfect. The primary β ray is under the existing circumstances however a hindrance rather than a help and efforts to eliminate its interfering action were made by improving the filtration.

Instead of using glass seeds gold capillaries were calibrated into gold seeds. But the wall thickness of the gold implants could scarcely be more than 0.3 millimeter and their size and increased ponderosity made them much less satisfactory for embedding in the tissues and with all this disadvantage the screenage was not even one half of what was needed to exclude the β ray and secure pure γ radiation.

In another procedure for the intratumoral or interstitial application of radium a number of needles with a definite radon content are inserted longitudinally into the cancerous cervix. When the desired dosage has been delivered the needles are removed. This may conveniently be done in 4 days at which time one half of the total γ ray activity will have been spent. In this way a

cervix while later recurrence usually means that the outposts of the cancer have been insufficiently treated. Further study is necessary which correlates the exact anatomical location of the recurrence with the special technique employed in particular case.

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In another procedure for the intratumoral or interstitial application of radium a number of needles with a definite radon content are inserted longitudinally into the cancerous cervix. When the desired dosage has been delivered the needles are removed. This may conveniently be done in 4 days at which time one half of the total γ ray activity will have been spent. In this way a

considerable dosage may be obtained. Thus if 4 needles of 10 millicuries each have been inserted then the total dosage of which these needles are capable is 5 332 millicurie hours since 4 times 10 millicuries times 133 3 equals 5 332 millicurie hours. One half of this dosage that is 2 666 millicurie hours will have been received in somewhat less than 4 days—the time when the needles are again extracted.

These hollow needles are made of platinum. The relatively slender caliber which is required for the purposes of interstitial insertion restricts the wall thickness of these needles to 0.4 millimeter at the most and this is clearly not sufficient to bar all the β rays from reaching the tissues.

Besides this a variable amount of necrosis occurs about the needles because secondary β rays are developed where the bare surface of the needle is contiguous to the tumor tissue. Needles that are open at one end and have simply been plugged with paraffin should not be used for it is evident that unfiltered rays must gain exit at this point.

In the treatment of the cervix for cancer the sphere of usefulness of implants and needles is limited to particular problems. An isolated vaginal deposit can sometimes be conveniently removed by implanting seeds. Transperitoneally, in rare instances seeds may be used to attack a secondary focus of malignancy where no other method is applicable. When a follow up treatment of the sclerosed and shrunken crater site to which the capsule does not readily adapt itself is necessary because there is evidence that beneath the surface some areas of the primary growth are still active the introduction of radon needles may be preferable.

What is desired is a simple standardized procedure which can be followed as a routine. The platinum capsule constitutes a unit which is adaptable to the treatment of most carcinomata of the cervix.

The radiation of the growth is attained by the intrapelvic and extrapelvic route. The intrapelvic treatment resolves itself into the intrauterine and the vaginal application of radium. The capsule is the essential integer in this procedure. The aim is to arrange a number of capsules in protective containers which conform to the local requirements. The extrapelvic phase of the therapy consists in radiation accomplished by means of the γ ray pack or where this is not available the high voltage γ ray.

The intra uterine applicator consists of three platinum capsules that are enclosed in tandem in a single soft metal free rubber sac.

By means of dressing forceps the applicator is carried up to the fundus of the uterus so that one capsule occupies the fundal the next the intermediate and the third the cervical segment of the uterine cavity or otherwise it reaches the level of the crater rim. A linen thread about 8 inches long is fastened to the lower end of the rubber container. Sterilized white vaseline facilitates the introduction and reduces the trauma.

If the canal is too narrow graduated sounds wiped with sterile white vaseline are preferred to the ordinary or parallel blade dilator. If a biopsy of the tumor is required it is obtained after the intra uterine applicator has been inserted.

Curettement extensive excochleation or cautery and all unnecessary manipulation or trauma are avoided. If an exophytic mass prevents proper access to the active portions of the growth it is best ablated near its base by means of the high frequency cutting electrode.

The vaginal preparation consists in simple cleansing with warm 1 per cent aqueous lysol solution. The nurse uses the digits of her gloved hand instead of the sponge stick. In a large series (April 1926 to November 1929) solupinol a steam distilled pine oil has been used in place of lysol. It is considerably milder than phenol in its antiseptic action as laboratory tests by R. C. Schleussner have shown but nevertheless seems peculiarly satisfactory in dealing with the putrefactive organisms which play a part as soon as the surface of the growth is broken. Where there is ulceration a coating of tincture of iodine can easily be applied directly to the lesion.

Even if the patient has voided the soft rubber catheter is used to make sure that the bladder is empty. The colon has been properly flushed by means of a warm water enema on the previous day.

Spinal analgesia with novocain gives the most perfect relaxation for the preliminary examination makes the procedure painless and causes no interruption in the upbuilding plan immediately afterward.

The platinum capsule is 25 millimeters in length or less. It has a wall thickness of 1 to 2 millimeters and an outer diameter of 4 or 6 millimeters. Its end can be unscrewed to receive the glass capillaries which contain the radon. The rubber sac is one half millimeter thick.

Each capsule carries an average of 7.5 to 30 millicuries of radium emanation and yields about 1 000 millicurie hours of pure γ radiation during an application lasting 48 hours. The total radiation delivered by the three capsules amounts to 3 000 millicurie hours. By doubling the millicurie

content of the cervical capsule the total radiation can be raised to 4 000 millicurie hours. This allows for loss by absorption which amounts to one tenth for 1 millimeter of platinum or one fifth for a millimeter capsule wall of the same metal. In other words to have the working effect of 25 millicuries actually, 27.5 millicuries must be carried if the capsule has 1 millimeter filtration and 30 millicuries if the filtration is increased to millimeters.

The radiation of the cervicovaginal junction adjacent vaginal segment paravaginal and parametrial lymphatics and connective tissue is attained by means of the vaginal applicator.

The vaginal applicator must be fitted to the rather varied conformation produced by the cancerous growth and as far as possible should be placed in direct contact with the tumor and its extensions along the vagina. Many of the rigid devices as well as the ordinary colpostat have therefore had a limited use.

A form of vaginal applicator which is simple quite adaptable and readily improvised is the radon ring. It consists of a ring of metal free rubber tubing of 11.5 millimeters outer diameter with 2.5 to 3 millimeter wall thickness and a 6.5 to 6 millimeter lumen which is just large enough to hold the capsules snugly. In a typical case the radon ring harbors three platinum capsules of 2 millimeter screenage and the same construction as those selected for intra uterine use.

When the ring is in place two of the capsules are in a favorable position while acting locally also to discharge the excess radiation into the cellular tissue and lymphatics of the retrolateral space between the broad and sacro uterine ligaments on each side. These capsules are charged with 30 millicuries of the radium emanation. The third capsule lies directly anterior and contains but 15 millicuries of the radioactive gas. In addition to its surface effect this capsule has to supply radiation to the subepithelial and submucous lymphatic meshes of this segment of the vagina as well as to the small area of vesicovaginal cellular tissue just in front of it. If this radiation is allowed to continue for 48 hours the total dosage received vaginally will amount to about 2 500 millicurie hours.

After deciding to what points on the vaginal aspect of the tumor the direct application is to be made or along what segments of the advancing crater edge in the vaginal wall the diameter of the vagina is measured or estimated at this level.

Because the circumference of a circle is approximately three times its diameter the length of tubing required for the ring is about three times

the diameter. Actually with the thick tubing that is employed the piece must be cut about 1.5 to 2 centimeters shorter because of peripheral stretching of the rubber tube when it is fashioned into a ring. After the ends of the rubber tube have been joined by means of a dumbbell shaped unit of unpolished wood a ring is obtained which is of the desired size. The joint is best placed posteriorly. First the anterior capsule is pushed to the middle of the tube then the retrolateral capsules follow on each side finally the open ends of the tube are connected by means of the dumbbell unit.

If it is desirable to apply a capsule to the tumor surface at some point within the ring a section of rubber tubing easily can be attached to each side of the ring by making a small longitudinal slit or button hole at the proper level and using the dumbbell unit. In this way a segment of rubber tubing which acts as the capsule holder can be firmly fixed within the ring.

If because of involvement the diameter of the vagina at the level of application is less than 4 to 5 centimeters or $1\frac{1}{2}$ to 2 inches the radon ring is not practicable as a capsule carrier. A piece of the rubber tubing doubled upon itself and joined by means of a dumbbell unit which is inserted into button hole slits made in the contiguous limbs of the tube forms a twin tube which can receive two capsules side by side. Sometimes no more than a single section of rubber tubing with a rubber stopper at each end can be used. The single tube the twin tube or the radium ring are applicators which can be improvised easily in a few minutes by using standard caliber metal free rubber tubing and the dumbbell joints.

Before the vaginal applicator is inserted it is wrapped with sterilized vaseline gauze strip or simply covered with a heavy coat of vaseline.

Sterile vaseline gauze strip packing displaces the bladder forward and the rectum backward and keeps the vaginal applicator in place.

Whenever this can be done both intra uterine and vaginal applicators are used at one session. After a 48 hour period of radiation both are removed. The patient receives a douche with 1 per cent solupinol in warm water and a warm water enema. She is allowed to rest at least 1 or 2 weeks before the intrapelvic therapy is re-enforced by any extrapelvic procedure.

After the use of radium a slight elevation of temperature occurs which usually does not exceed 101 degrees F rectally. This is somewhat analogous to the protein fever which reaches its greatest rise within 36 hours after an aseptic operation. If the pyrexia goes beyond this maximum rise an infection is likely to be responsible.

and the radium has to be removed. It is a serious violation of good judgment to institute radiological treatment when an active pelvic process exists. The radiation is not well tolerated by the tissues which surround the cancer territory when these have been acutely infected. Their resistance is temporarily diminished because of the toxic action of pathogenic organisms. Gangrene of the adherent fallopian tube and appendix has occurred in such a situation subsequent to the intra uterine application of radium.

Nausea and vomiting of small quantities of bilious fluid may occur at the height of the process and are perhaps due to split protein toxicosis from the breaking down of the cancer tissue.

The chief complaint is often the dull pain in the back. It is clearly of pelvic origin and localized characteristically about the posterior superior interspinous line.

There may be frequency of urination but no real dysuria no more than a complaint of slight burning on voiding. Catheterization or bladder drainage seems meddlesome no harm can come from the visceral shifting caused by the normal filling and emptying of the bladder.

Exceptionally there may be a cystitis or a proctitis which takes several weeks to subside. Proctitis was more frequent formerly when rectal application was used to treat the posterior parametrium. The rectal mucosa is so much more sensitive to the application of radium than the uterine cavity or vagina that the procedure is no longer one of choice.

A loop of the ileum frequently lies in the posterior cul de sac. Vaginal packing displaces it from this position. It has happened that a loop of small bowel which was contiguous to the dorsum of the uterus was damaged during the intra uterine use of radium. A radium burn might lead to adhesions of the bowel to the uterus and intestinal obstruction. An unduly large dose of radium with insufficient screenage of the primary β rays may readily invite such a complication.

It is good practice to place the vaginal packing securely so that the nurse may change the posture of the patient during the 48 hour session of radium treatment. By following this plan instead of enjoining the patient to remain constantly on her back, the relations of the pelvic viscera are shifted to a sufficient extent to avoid the continuous radiation of one surface of an organ.

The anemia particularly in advanced cancer of the uterine cervix takes the form of a chloroanemia. There is a moderate reduction in the total number of erythrocytes but the hemoglobin is considerably decreased so that the in-

dividual red cells are quite pale. The hemoglobin may be as low as 30 to 60 per cent and is the index of the chlorosis and not of the anemia due to uterine bleeding. The clinical course in most instances shows a disproportionate drop in the blood color index while relatively little uterine bleeding is going on. It may be that the hemolytic products which are set free at the site of cancer necrosis are causal. If the chloroanemia is not the direct outcome of a loss of blood and there are hemolytic substances actually present in the blood of these patients it is perhaps comprehensible why the response to transfusion of blood is on the whole not very satisfactory.

In the larger degenerating tumors there is apt to be a slight hyperleucocytosis of the polymorphonuclear variety. With radiation a leucopenia may be induced. This is probably traceable to extensive aggregations of polymorphonuclear neutrophils at the cancer site which undergo dissolution with the cancerous growth. For the time being the demand cannot be met by the supply and a transient leucopenia develops. If the leucopenia does not disappear promptly this implies a serious incompetency on the part of the blood forming organs.

It is to be taken into account that in applying the vaginal ring the capsules are *eccentrically* and not centrally situated and at least 2 to 2.5 centimeters distant from the uterine axis. The rays from this applicator therefore are more effective in the periphery than those which emanate from the uterine source.

If there is mobility of the structures as in patients in whom the doubtful areas are not extensively invaded the radon ring may be brought still closer to the pelvic wall in either of these districts. To accomplish this the ring is weighted by inserting several plugs of lead or bullets in tandem and together with the capsules. By its gravity the ring will necessarily shift in the direction toward which the patient is inclined.

In the routine treatment which includes both doubtful areas the patient is tilted by the nurse alternately into a right or left semilateral position from time to time while a pillow supports the hollow of the back.

The number of γ rays emitted by even a small quantity of radium is probably infinitely greater than the actual number of cells in any cancerous growth. Individual or dispersed rays cannot have a lethal effect. A certain degree of concentration may stop mitosis or induce temporary suspension of cell activities but with greater concentration the cell becomes irreparable and disintegrates in nucleus and body.

The problem is how to deliver the γ ray activity in proper concentration to the cancer district without dealing a damaging charge to the sound organs and tissues which intervene

One solution is based on the application of the principle of crossfiring. The penetrating power of the γ ray is not at fault. It takes about 20 centimeters of soft tissue to absorb these rays entirely. The fact is, however, that the bundles of rays become dispersed, their concentration or intensity decreases rapidly and inversely to the square of the distance they have to traverse.

So it happens that the therapeutic effect as far as the destruction of cancer cells is concerned is actually lost at a distance of 2 to 3 or 4 centimeters from its source. Since the radii of the true pelvis at this level vary between 6.0 and 6.5 centimeters, it is evident that the remoter foci may not come within this range.

By using in addition the γ ray pack in *extra pelvic* treatment by means of crossfiring the γ rays can be made to converge at any point in the pelvis. The γ ray beams otherwise attenuated by dispersion are reinforced by others which enter from another angle or field. The plan is to choose the focus for the crossfiring rays so that it will lie within those districts which would otherwise have received insufficient radiation.

The thought is not new that instead of λ rays the γ rays from larger quantities of radium could be used similarly in extrapelvic treatment in the form of an adequately constructed radium pack. It probably originated with Janeway more than a decade and a half ago.

Since in all of the insufficiently radiated zones the cancer must continue to grow the central should be supplemented by the peripheral radiation at the earliest moment possible.

When the right or left iliac regions are chosen as portals of entry, the patient lies on her back. For the right or left parasacral fields she is placed in the ventral posture. The abdominal organs are shielded with lead. In both postures a pillow is put under the patient near the iliac crest. This helps to turn the pelvic inlet toward the source of radiation so that the rays can be directed into the true pelvis. For better crossfiring effect on the periphery the right side front and back are radiated on the same day, the left side front and back on another day. Or else both sides front and back are taken in turn on the same day. In this way, the more inaccessible cancer cells that have been insufficiently radiated will receive a crossfiring dose before they have had time to recover.

In cancer of the cervix a vulvar field for extra pelvic radiation is usually not selected because

the central sections of the cancer have previously been more directly influenced by the intrapelvic treatment.

Hypogastric or sacral portals of entry are generally avoided. The bladder and rectum have already been the unavoidable targets for aberrant rays during the *intrapelvic* application of radium.

Essentially the γ ray pack consists of a massive cup of lead which holds in multicentric distribution a large quantity, 2 to 4 grams of radium usually in the form of radium sulphate. The ponderous metal of which the cup is made acts as a shield against the radium on all sides excepting its open end through which the filtered rays are allowed to escape. The filtration amounts to somewhat more than the equivalent of 1 millimeter of platinum which clinical experience so far has shown to be ample for this form of therapy. The radium pack is never close to the skin but as a rule is operated at a distance of about 10 to 15 centimeters from its surface. A sliding mechanism allows it to be raised or lowered. The pack is suspended from the sliding mechanism by means of a universal joint so that it can be adjusted to any angle or fixed in any direction.

A 4 gram pack is in the possession of the Radium Institute of Paris, another in the General Memorial Hospital of New York. If a more or less advanced carcinoma of the cervix requires a dosage of approximately 240,000 milligram hours the pack makes it possible to deliver this large dosage within 2 or 3 weeks without rendering the individual treatment altogether too trying for the patient in point of duration. With the 4 gram pack which is operated by W. H. Cameron of this city the corresponding plan would be to administer such a dosage through a longer span of time covering not less than 4 to 6 weeks. Experience in this direction is still too limited to decide which is therapeutically the preferable procedure. The general trend has been to concentrate the treatment as much as the patient's tolerance will permit. According to Cameron's observations it is possible with the 4 gram pack to supply 1,000 milligram hours to the tumor outskirts for example in the course of 1 week without causing any serious epidemoidal reaction. There are very few untoward symptoms excepting a transitory nausea. This session is not undertaken until about 1 month has elapsed after the intrapelvic treatment and is not repeated before another month.

The crossfiring of the invaded territories can be carried out by means of high voltage λ rays instead of the γ rays from the radium pack when this is not available. It must be sufficiently

diffuse and intensive to attain complete catalysis of the cancer before much time has elapsed and widespread sclerosis appears. For this reason the extrapelvic treatment should be as concentrated as the individual's tolerance will permit. At the New York City Cancer Institute I Levin distributed the individual treatments with high voltage X ray through a period of 6 weeks while I Kaplan gives as many as two treatments a day thus attaining a skin erythema depth dose within 1 week. With proper attention directed toward the protection of other organs such as the spleen and the adrenals the pelvis itself may safely receive very intensive X ray treatments. By the correct choice of fields and their alternation together with the expedient of crossfiring the proper depth dose is given without damage to the surface. The initial radiation cellulitis and peritonitis as well as the ultimate extensive pelvic sclerosis can be seen when for some cause the abdomen has to be opened after the patient has been subjected to a serial deep X ray treatment. How much still viable cancer remains in this sclerotic mass cannot be estimated. If at some time a latent cancer cell shall assert itself remains in doubt. A portion of the outlying parametrium has not been effectively reached by the γ rays in the intrapelvic treatment with radium. The span to be traveled is only 6 to 6.5 centimeters from the uterine axis to the pelvic wall. The reason is not the lack of penetration by the γ ray which is not fully absorbed until it has passed through about 20 centimeters of soft tissue. It is due to the divergence of the rays which occurs very rapidly and is inversely proportional to the square of the distance from its uterine or vaginal source.

The fields for the portals of entry are chosen low in each iliac region and over the right and left gluteal region below the level of the sacral promontory. In the obese the gluteal fat may necessitate the shifting of the posterior fields to ward the sacrum. The passage of the rays is considerably impeded by larger masses of fat or the bony structure of the true pelvis. The X ray equipment which is generally employed in radiography is unsuitable for cancer therapy. The four machines in use at the Cancer Institute each have a capacity of about 200 000 volts and the average voltage used varies between 130 000 and 180 000 (D Ehrlich). The aim is to apply only shorter wave length X rays which are capable of greater permeation and are not largely absorbed before the tumor district is reached.

For the γ rays of radium on the contrary fatty tissue or bone offers very little hindrance to penetration and with proper filtration there are few

soft rays absorbed on the way to the neoplastic area upon which the crossfiring is focused. In order to produce X rays of the same hardness and short wave length as the γ ray it would require a generator with a capacity of 500 000 to 2 000 000 volts (C H Viol).

In radiotherapy it has been a matter of general experience that the type of growth which possess the greater degree of biological malignancy are also more radiosensitive perhaps because of the outstanding action of radium on mitosis upon which biological malignancy in a great measure depends.

Those tumors should therefore naturally be more radioresistant which are less anaplastic and show better differentiation and in which mitosis and cell division recede as the differentiation or specialization of cells in the tumor proceeds.

Of the epidermoid cervical growths the epithelioma with prickly cells and cornification extend into the broad ligament more slowly than the other types and is from the surgical point of view the most benign of all cancerous growths of the cervix and at the same time relatively the most recalcitrant to the influence of radiation.

There are 4 rather well characterized clinical phases of the cervical lesion after radium treatment. In the smaller exophytic lesions the dusky red and relatively glossless mammillated tumor contrasts in sharp outline with the smooth uninvolved portion of the hyperæmic exocervix. The fine red lines of overfilled vessels indicate that the radium has had its effect. The young cancerous patch or nodule or ulcer is usually eccentric in its location. It involves only one lip of the cervix or its angle or the surface lesion already may have reached the vaginal junction as is likely to be the case in the more common epidermoid type of the growth. What is going on within the healthy environment under the action of the radium is nothing more than a histological and physiological expression of defense for this is what an exudative inflammation really means.

The molecular disturbance caused by the γ ray in the tumor itself stops the process of mitosis on which cell multiplication depends. There is a stasis of the interfilial fluid in the cell the cell body swells. The cytolysis which is going on shows itself by vacuolization in the nucleus and protoplasm. The cell outline becomes indefinite the staining properties and chemical reaction change the nucleus breaks up and undergoes dissolution.

In the clinical phase there is at first apparent hyperæmia and capillary injection of the surface around the growth. In the course of 1 or 2 weeks

evidence of surface necrosis is seen with the formation of a greenish slough. According to the extent it takes 2 or 3 weeks more for the slough to separate so that it can be cast off and expurgation is accomplished. Sometimes the slough is tardy in demarcating and may linger until the sixth or eighth week. Finally the defect in expurgated areas on the surface as well as in the deeper strata heals by granulation and scar formation according to the same unalterable laws that dominate the healing of wounds generally.

The changes that are brought about in the pelvis by radiation are extensive. In essence they are primarily due to an aseptic exudative inflammation in the peritoneum and cellular tissue with hyperæmia and lymphostasis. Wherever cancer deposits are disintegrating the leucocytes permeate the structures in large aggregations. The massive dosage dealt to the cancerous growth has also temporarily devitalized many healthy cells. This together with the widespread stagnation of the tissue fluids that exists makes the situation peculiarly serious in infection. An operation should therefore never be undertaken a few days after radiation.

In the course of 10 to 14 days the radiation peritonitis has become subacute the healthy tissues in the pelvis and the patient herself have had time to recover. However before the inaugurated transformation has entirely ceased particularly in the connective tissues months or even a year may elapse. The surgeon meets with firm adhe-

sions in the pelvis and hard fibrous or leathery masses replace the loose cellular tissue between the broad and sacro-uterine ligaments and the base of the bladder and encumber the execution of an extended operation.

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THE TREATMENT OF INTRACAPSULAR FRACTURE OF THE HIP JOINT

BY THE METHOD OF EXTENSION ABDUCTION AND INTERNAL ROTATION (WHITMAN'S METHOD) WITH
ESPECIAL REFERENCE TO THE GROUP AGE SIXTY AND BEYOND

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THE Orthopaedic Division of the Mount Sinai Hospital of Cleveland, Ohio, a general hospital of 290 beds situated in a thickly populated part of a large industrial city has had full charge of the fracture service for the past 14 years. The staff members have had under their care a sufficient number of cases of intracapsular fracture of the hip joint which with the exception of 5 cases have been invariably treated by the method of extension abduction and internal rotation (Whitman method) to warrant as comprehensive as possible a review of the results secured. The following compilation is the result of this checkup. No case is tabulated unless it has been examined by a member of the orthopaedic staff of the hospital or dispensary at least 2 years after discharge from treatment.

We were fearful at first that because of the large number of patients who had died who could not be found or who refused re-examination the number herein reported might not be a true cross section of the work done (119 in all). However we know that the tabulation in Group 2 (cases from 40 to 50 years) is an accurate and true picture of all the cases of fracture of the small part of the neck of the femur that we have had in this age group in these 14 years. We also believe that the report on the age group from 70 years upward (which includes less than one half of the total number of cases) represents a rather true picture. We therefore do not hesitate to present our final figures as a rather fair summary of the entire group with which we have had to deal.

The preponderance of females over males practically 3 to 1 is striking especially when one takes into consideration the fact that men are more likely to be exposed to injury.

In all patients below 40 years of age the fractures united. This was also true of the entire group of unchecked cases which were rather few in number and could easily be remembered as no difficulty was experienced in treating them.

In Group 2 patients from 40 to 50 years of age we found our most disappointing results. A careful review of the history showed that in some instances the fractures had been produced by a minimum amount of violence due to the fact

probably that many in this group were asthenic individuals in poor general health or were suffering from general systemic disorders. It is our belief that if the hip bones are absolutely normal they do not readily fracture in patients from 40 to 50 years of age but that more commonly the acetabulum may be fractured or there may be a central dislocation or intra trochanteric fracture. The fact that in 2 cases of non union luetic osteoarthropathy was found attests to the fact that in some of these cases there was a predisposition to non union caused by a pre existing lowered resistance in the region of the neck of the femur which obviously rendered the healing of the fracture more difficult.

In Group 3 patients from 50 to 60 years of age the results of this treatment were most gratifying with 13 or 87 per cent of union and 1 or 13 per cent non unions. Although this group falls within the age range in which fracture of the neck of the femur is most prevalent the large number securing union may be attributed to the fact that in most instances patients at this age possess better vitality and recuperative power. It is also interesting to note that all the male patients in this group 3 in number obtained union and good end results.

In the group of patients more than 70 years of age the favorable results we believe are due to the fact that most of the patients were thin and wiry and in robust health. Less fortunate patients in this group either died or secured no union. The patients treated primarily with the Bradford traction abduction brace showed the highest percentage of union—1 death and 3 with union. However the number of cases is altogether too small from which to draw any conclusions and the brace was used only to meet special conditions when it was not possible to use the Whitman cast.

In the entire series of cases the method of treatment has been fairly uniform. In all except 5 cases the Whitman abduction method was used and in most of the cases Bradford abduction or Thomas walking splint was later applied. From the data tabulated it would appear that the splints—Thomas or Bradford abduction—are

GROUP 1—UP TO 39 YEARS OF AGE—9 CASES

| Name | Sex Age | Time | Result | Remarks |
|-------|------------|---|---|--|
| P B | M 8 | Whitman bdu to st 6 wk | Perf t | Wk d w k utch s with t aft th d |
| M J M | M 12 | Wh t m c t 3 mo | U w th a | S b t r o h a t e n o s t o m y 6 y s l t r a b h t g |
| R C | M 14 | Wh t m a t 3 m | P f t | |
| G C. | M 7 | Wh t m a t 3 m s | P e f t | |
| R L | M 19 | Whit m a t 3 m s | W h h t g U w th m d d a o d d u t o d f m t y | A o t d t h t e n g f e t m l l t e r l l g m e t f k |
| M F | F 16 | Wh t m t 3 mo | P f t | |
| L G | M 37 | Wh t m t 3 m b 3 m (B d f d a b d c t n) | M o d r t w th h t g | N o d b l i t y |
| L M | F 33 | Wh t m c t 3 m | M d t o w th h t m g | 4 p l u s W s s e m a |
| L P | F 39 | Whit m a t m o s | P i t u | N l i m p h t e g |

SUMMARY OF GROUP 1

| | C | P | Sex | C | P |
|----------------|---|-----|------------------|---|----|
| Mortality | 0 | 0 | Severe deformity | 1 | 11 |
| Non union | 0 | 0 | Complications | 0 | 0 |
| Union | 9 | 100 | Male | 6 | 66 |
| Mild deformity | 4 | 45 | Female | 3 | 33 |

GROUP 2—40 TO 50 YEARS OF AGE—10 CASES

| | | | | |
|------|---------|---|---------------------|--|
| K R. | F 47 | Wh t m a c t 3 wk | U h h t m g r o i d | C t m d b y h u b a n d f t e t h w k |
| A G | F 43 | Whitman ast 3 m | N u n i o n | |
| A K | M 48 | Wh t m a t 3 m o s | N u n i o n | D i p e d C h t j u n t l i p p d w h l b o w l i n g |
| A S | M 49 | Wh t m a t 3 m o s B d f d b d t p l a n t m | N o | D i p d C h t j u n t f a t e d w h l g g t g l f b l l |
| A F | F 49 | Whit m a t 3 m o | N | |
| M T | F 5 | Wh t m a t 3 m p l a n t 6 m o | N u n i o n | F t d b y t w l g h p |
| C G | F 5 | Wh t m a t 3 m o s | U n j h h t m g | |
| I F | F 40 | Wh t m a c a s t 3 m o s | N u n i o n | B g r f t a f t n y a n t 1/2 n h h c g |
| O B | M 49 | Wh t m a t 3 w k | N n a | C a s t m o d b e u s f r e u m n i B a d f d b c f u s e d |
| N H | F | Whit m a a s t 3 m o s | U 3/4 n h h t m g | |

SUMMARY OF GROUP 2

| | C | P | Sex | Cases | P |
|----------------|---|----|------------------|-------|----|
| Mortality | 0 | 0 | Severe deformity | 0 | 0 |
| Non union | 7 | 70 | Complications | 3 | 30 |
| Union | 3 | 30 | Male | 3 | 30 |
| Mild deformity | 2 | 66 | Female | 7 | 70 |

*Of w r d a s e

† Charcot joint p e u m o i a

GROUP 3—51 TO 60 YEARS OF AGE—15 CASES

| N m | Ag | T m t | R lt | R mark |
|-------|------|---|---------------|--|
| M H | F 5 | Wh tms t 3 m | U h h t e g | |
| E Z | F 5 | Wh m ast m | N | |
| F M | F 5 | Wh m t 3 m | U | |
| M G | F 5 | Wh m t m | h h | |
| R M C | F 5 | Wh m 3 m | h h l | D i l t f m |
| S W | F 5 | Wh ma 6 mo 3 m Thos lk | h h t g l t | Wlk fl |
| ll li | F 5 | Wh ma 6 mo Th m pl | N u | Albee ft p Wh ma t ood ul 9 m h l b |
| ll k | M | Wh m m | U / h h g | |
| L R | F 5 | Wh ma 3 m Th m pl | U 3 h h g | |
| ll B | F 5 | Wh tm 3 m Th m pl | U N d f m y | |
| M f | F 5 | Wh tm 6 m t 3 m Th m pl | U h h g | l p d m l m l s m b |
| M | F 5 | B h d bd t pl | U so N h t g | |
| B | M | Wh m k | l m j h h t g | |
| J O | F 5 | Wh ma 9 wk bed t 5 m k Th m wlk g t 5 m | F m N b g | |
| K H | F 60 | Wh m t 3 m | U h h g | |

SUMMARY OF GROUP 3

| | Case | P t | S re defo m ty | C se | P |
|----------------|------|-----|----------------|------|----|
| M t l ty | 0 | | Jo t m pl at | 0 | 65 |
| No | | 3† | M le | 3 | 2 |
| L | | 87 | F mal | | 80 |
| M l d d f m ty | 3 | 69§ | | | |
| ‡ B h f m l | 9 | | | | |
| ¶ l b t h | | | | | |
| g O f d | | | | | |

used principally to protect the healing fracture to protect the weak trabeculae from re fracture and to prevent formation of coxa vara rather than to circumvent the primary causes of non union

A study of the cases of non union has suggested division into two groups first those in which progressive destruction and absorption of the neck of the femur result in frank non union with upward riding of the trochanter and consequent shortening and disability second those in which check up X ray examination at certain periods showed for a period of from 3 to 9 months after the fracture a seeming maintenance of the position obtained at reduction with no evidence of diminution in the size or contour of the neck of the femur but with questionable evidence of callus and union which later meant non union While this latter condition has been noted in some instances after the hip spica had been removed and the patient allowed to get up and about in a Bradford or Thomas walking splint it has also been found in cases during the course of the Whitman abduction cast treatment

Because of the peculiar blood supply of the head and neck of the femur the degree of displacement unquestionably plays an important role in the consequent damage to blood supply the greater the displacement the more serious the damage to the blood supply It is conceivable that in cases of a more or less complete isolation of the head and proximal portion of the neck particularly in old and debilitated patients no form of fixation however long continued would result in union

On the other hand in cases with little or no displacement or a minimal damage to the blood supply it would seem that union would more likely result This factor could not be checked up properly on account of the practice of destroying X ray plates more than 5 years old and because of a recent local movement to destroy all in flammable films in the X ray laboratories of our city

As to the method of treatment the almost miraculous relief from pain and the ease with which we could handle these patients when the

GROUP 4—61 TO 70 YEARS OF AGE—28 CASES

| N m | Sex Age | Treatment | Result | Remarks |
|--------|------------|------------------------------|---------|-------------------------|
| Mrs K. | F 63 | Whitman t 3 m | U | Old fall probably fatal |
| M A | F 64 | Whitman t 6 m | N | a |
| A R | F 64 | Whitman t 3 m | U | h h t g |
| A L | F 65 | Whitman t m | N | |
| B G | F 65 | Whitman t 4 d 3 | | S dd d th y d i se |
| J P | M 63 | Whitman t 3 m Tib m pl t | P f t | |
| M S | F 65 | Whitman t 3 m | U | h h t g |
| M B | F 65 | Whitman t 3 m | N | Cardiac lar idea e |
| T W | M 69 | Whitman t 3 m Tib m w lk g | U | |
| W B | F 69 | Whitman t 3 m | P f t | lt |
| A C | F 69 | Whitman t 3 m Tib m pl t | N | |
| S B | M 66 | Whitman t wk | F m g N | se f b t |
| M H | F 66 | Whitman t 3 1/2 m pl t 6 m | U | p f t |
| M K | F 66 | Whitman t 3 mos Tib m w lk g | N | |
| L E | F 66 | Whitman t 3 m | P f t | |
| T O | F 66 | S d t g | U | with m ld |
| M F | F 66 | Whitman t 3 mos | U | s h h t |
| A R | F 66 | Whitman t 3 m w lk g pl t | N | o |
| E A | F 67 | Whitman t 3 m | N | m |
| K H | F 67 | Whitman t | U | dd too d f nuty |
| J D | F 67 | Whitman t 3 m w lk g pl t | U | in h t g |
| C M | F 67 | Whitman t 9 day | | |
| A B | F 67 | Whitman t 3 mos Tib m d d bd | U | s h h t g |
| E H | F 67 | Whitman t 3 mos pl t 6 m | N | m |
| I E | F 67 | Whitman t 3 m pl t 6 m | U | s h h t g |
| J H | F 67 | Whitman t 3 mos | N | una |
| M H | F 68 | Whitman t 3 m | U | |
| J T | F 65 | Whitman t b | U | |

SUMMARY OF GROUP 4

| | C | P | t | | C | P | t |
|------------------|----|----|---|-----------------------|----|----|---|
| Mortality | 2 | 7 | | Non union complicated | 2 | | |
| Non union | 9 | 32 | | Other fractures | 3 | | |
| Union | 17 | 68 | | Male | 5 | 18 | |
| Mild deformity | 7 | 41 | | Female | 23 | 82 | |
| Severe deformity | 1 | 6 | | | | | |
| Operated | | | | | | | |

GROUP 5—71 YEARS OF AGE AND MORE—17 CASES

| Initials | Age | Trauma | Result | Remarks |
|----------|-----|-------------------|--------------|--------------------------|
| E W | M | Whitens t m | P f t m | Som b t ing |
| S K | F | Wh m as sm | P f t m | |
| M P | F | Wh m 3 m B d d bd | N | W lk w ll w h m u b l op |
| I W | F | B d d T t m 6 m | P f t h t g | |
| L H | F | B d d T t m 6 m | | D d d l d ea B d ea ex t |
| E M G | F | Wh m 3 m | U on ho g | |
| L G | F | Wh m t 3 m 6 m | U | |
| R H | F | Wh m m B 6 m th | P f t p | |
| S T | M | Wh m 3 m pl t m | P f t p | |
| M S | F | B d d T t m 6 m | N h te g | |
| L C | F | Wh m t m B d 6 m | h h te t f t | A d hes |
| E W | F | N ur t m t | h h te t f t | D d davs myocardius |
| E P | F | Wh m | | D d davs p m m |
| E S | M | Wh m 3 m | h h b t g m | |
| A F | F | B d d bd t m 6 m | N | B peg th j h h f |
| A B | M | Wh m 3 m | h h m g. uoq | |
| A B | F | Wh m t m | N | |

SUMMARY OF GROUP 5

| | Case | Per t | | Case | Per t |
|----------------|------|-------|--------------|------|-------|
| Mortality | 3 | 17.5 | Seedeformity | | 9 |
| Nonunion | 3 | 17.5 | Male | 4 | 23.5 |
| Union | 11 | 72.5 | Female | 13 | 76.5 |
| Mild deformity | 2 | 11.8 | | | |

SUMMARY OF GROUPS 4 AND 5 AGES ABOVE 60 YEARS—45 CASES

| | Case | Per t | | Case | Per t |
|---------------------------|------|-------|--------------------|------|-------|
| Mortality | 5 | | Unawthseedeformity | | 5 |
| Nonunion | 1 | 30 | Male | 9 | 20 |
| Union | 8 | 7 | Female | 36 | 80 |
| Union with mild deformity | 9 | 25 | | | |

proper mechanical devices were used to lift them were so startling and pronounced that we shall continue with this practice unless it can be shown by preponderance of evidence that results from some other method are far superior to our

In our experience the diagnosis of intracapsular fracture is not difficult. Any person above the age of 55 years who falls down and is not able to arise and walk who has shortening and external rotation who is not paralyzed and whose foot, leg or thigh is not fractured has an intracapsular fracture of the hip. Diagnosis can be readily verified at once by an X-ray examination.

A general anæsthetic is usually not necessary as local or spinal anæsthesia is almost always satisfactory. The usual stiffening of the knee joint can be prevented by incorporating ring locks into the cast at the knee the plaster being cut away here so that the knee can be exercised at the end of the sixth week. If a plaster cast can not be used the patient can be fitted with a Bradford extension abduction splint after the classical manner recommended by Bradford in his final paper in the *American Journal of Bone and Joint Surgery* and the final result will in no way be impaired.

EMPHYEMA IN CHILDREN

GEORGE B. PACKARD, JR., M.D., DENVER, COLORADO

OBSERVATIONS on the following series of 64 consecutive cases of empyema in children and infants bring out certain conclusions that seem worthy of discussion. Consideration has been limited to surgical treatment and prognosis.

Empyema in an infant or a young child is to be considered somewhat differently from that in an adult. The vital capacity in a young child is so small that a moderate collection of pus or a far sized pneumothorax seriously interferes with proper oxygenation and the latter in particular can easily lead to a fatal asphyxia. Then too the mediastinal structures forming a septum between the right and left chests are very lax in the child so that an inflow of air into one chest causing collapse of that lung will push over the mediastinum and seriously embarrass the opposite lung and the circulation. It is probable too that early adhesions in a child are even more delicate than in the adult and are much more easily ruptured with wide lung collapse if much pressure is brought to bear on a walled off area.

MORTALITY

Mortality rates for children given from different clinics vary tremendously. The variation depends somewhat upon whether only operated upon cases are figured or all cases including those too nearly moribund to allow surgery. A few have been selected as typical examples.

L. E. Holt New York Babies Hospital 127 cases up to 2 years of age 65 per cent mortality

Brown Children's Hospital of Philadelphia 259 cases up to 8 years of age 6 per cent mortality

Spence Babies Hospital of New York 111 cases up to 3 years of age 44.6 per cent mortality

Ladd and Cutler Boston Children's Hospital 208 cases 17 per cent mortality, under 2 years 35 per cent mortality

Pybus London Hospital for Sick Children 100 operated upon cases 24 per cent mortality

Comby Paris 107 cases up to 5 years of age 54.2 per cent mortality

Farr and Levine New York St. Mary's and New York Hospital 359 treated cases 20 per cent mortality

McEnery and Brennenman Children's Memorial Hospital Chicago 37 cases treated by aspiration 12 per cent mortality

In our series of 64 cases treated at the Denver Children's, the Colorado General and the Denver County Hospitals the oldest child was 15 years of age. I have not included in this series a few cases in which no surgical treatment was given due to the condition of the patients and a few cases found by autopsy to have empyema. However, patients treated by only one aspiration are included.

In the 64 cases there were 4 deaths, a percentage of 6.5. Two of these deaths were in cases in which aspiration alone was done as a temporary procedure during an acute pneumonia. That leaves only 2 deaths following real operative procedure, a mortality of 3.13 per cent. The cause of death in all 4 cases was pneumonia, 1 case being complicated by otitis media and meningitis.

AGE

The oldest age in this series was 15 years, the youngest 4 months, the average being 5.8 years. There were 11 cases up to 2 years of age. The 4 deaths occurred in patients aged 5 years, 4 years, 1½ years, and 6 months, which gives a mortality of over 18 per cent in the children of and under but of less than 4 per cent in the children over 2. This rapid increase in mortality as the age decreases corresponds to figures reported by other clinics.

SEX, TEMPERATURE AND WHITE BLOOD COUNT

Two of those dying were girls, 2 were boys, showing no sex preference. The average temperature at time of treatment was 101.8 degrees, varying from 99 to 104. There was nothing in the temperature of the fatal cases to distinguish them from the others. The white blood count in the 64 cases varied from 6,000 to 36,000 and averaged 18,500. The average in the fatal cases was almost the same. The lowest white count, 6,000, occurred in a fatal case; the next lowest, 9,000, made an exceptionally rapid recovery.

DURATION BEFORE OPERATION

This is apparently the most important factor of all influencing the outcome of the disease. The average duration before treatment in this series as nearly as could be estimated was 3.5 weeks and varied from 3 days to 7 months. The fatal cases were treated an average of 5 days after onset, 19 days under the average. These figures make a

most powerful argument against early operation even though two of these cases were treated by aspiration alone. When he reported a lessening of mortality with each week that operation was deferred up to the seventh and eighth week from the beginning of the disease after which the mortality showed a rapid rise. Most clinics realize now the value of delay and the old plan of early diagnosis and emergency operation has been completely discarded. The terrific mortality figures given by writers only a few years ago are probably largely the result of early operative treatment. Whenever possible no operation should be done until the active pneumonia has completely subsided. If it is feared the patient is suffering from fluid pressure or toxic absorption aspiration alone in moderate amounts should be practiced until the lung is clear of consolidation.

CHARACTER OF PUS

Closely related to the duration of the empyema before treatment is the character of the pus found at operation. Of the cases noted in this series the pus was thick in all but six. In these the fluid was described as thin slightly cloudy or turbid. It is of greatest significance that in 3 of my 4 deaths the fluid obtained was thin. It is a good rule never to operate upon an empyema until the fluid becomes frankly purulent—not cloudy, not showing pus by microscope but grossly of a milky or creamy consistency. Aspiration of small amounts of clear fluid is permissible if pressure seems severe.

AMOUNT OF PUS

The amounts noted varied from 5 cubic centimeters to over 1500 cubic centimeters and averaged 315. The amounts in this series seemed to bear no relation to the mortality and I do not believe should influence treatment except that removal of too large amounts at one time seems to raise temperature and cause other toxic symptoms perhaps due to undue pull on a collapsed lung.

METHODS OF TREATMENT

While the great majority of these cases were treated by a closed method of drainage there were enough open drainage cases and aspirations to consider some comparisons. Treatment was instituted as follows: in 4 cases aspiration, in 10 rib resection or open intercostal drainage and in 50 closed drainage. Aspiration was used only in early cases or in cases considered too sick for greater interference. Rib resection or open intercostal drainage was used in cases of long standing encapsulation or in cases in which the pus was too thick to get out through a catheter.

Aspiration. There were 4 cases treated by aspiration alone. No antiseptic solution was used nor any washing out in these four. The previous duration of the disease was short averaging only 7.5 days. There were 2 deaths in these 4 cases. These 2 deaths occurred in patients needed in the hope of relieving some of their toxicity. Neither death truly represents mortality from an operative procedure. The two cases surviving (not desperate cases to start with) went on to complete recovery without complication or secondary operation and remained in the hospital only a little over 2 weeks. This is not in any way a fair estimation of aspiration as a treatment. Sixteen other cases were aspirated from one to four times preceding other operative procedures and two of these had also instillation of gentian violet. Operation was done in most of the 16 cases according to our custom of operation when the pus becomes thick and the pneumonia has subsided in the remaining cases because no progress was apparent or because it was impossible to aspirate the pus through a needle.

In fairness to the procedure we should mention at least 3 reports in the literature. McEnery and Brenneman in an article published in August 1929 report 37 empyemas of children treated during the year 1928 of which 3 received aspiration alone (from 1 to 11) with 4 deaths. Infants apparently responded the best. Of some moment however is their note that the average hospital stay was 3 1/2 months. Lowenburg reported 9 cases of pneumococcal empyema treated by aspiration and injection of ethylhydrocupreime. Major reported 27 cases treated by aspiration followed by injection of gentian violet of which 14 were cured without other procedure. Five died the average stay in hospital of successful aspirations not requiring later thoracotomy was 76 days.

Open drainage. Rib resection or open intercostal drainage was used as a primary procedure in 10 cases with one death a mortality of 10 per cent. The average duration of the disease preceding operation was 36 days or 12 days above the average. The one death following rib resection occurred in 1921 in a case operated upon 5 days after the onset of the empyema and was caused by extension of the active pneumonia. It is apparent that this group represents later cases with thick pus and good encapsulation. Outside complications were conspicuous by their absence. In this group there were two secondary operations: one a separation of adhesions and the other a drainage of a subdiaphragmatic abscess. None went on to chronic empyema and healing was complete on the average in 4 days.

All these cases were irrigated two or more times a day with Dakin's solution which rapidly changed the foul purulent discharge to a clear almost sterile one. For these well encapsulated late cases which have survived the early dangers of toxæmia it seems probable that good efficient drainage helped by frequent antiseptic irrigation may give the most rapid recovery. Except for one operation inexcusably early according to present knowledge this group represents a more favorable class of cases than the preceding or the following.

Closed drainage. Closed drainage was performed in 50 cases with one death giving a per cent mortality. The average duration of the disease previous to operation was 3 weeks and varied from 5 to 7 months. These operations on the whole were done much earlier than in the last group. The one death followed operation to withdraw a thin cloudy fluid during active pneumonia the patient showing steady extension of the pneumonia and dying in 2 days. Autopsy revealed double pneumonia, otitis media and meningitis. Here again an operation was contra indicated and hastened death.

Outside complications were numerous and consisted of meningitis, extension of pneumonia to opposite lung (2), mastoiditis (1), nephritis (3), otitis (8), endocarditis (1), chicken pox (5), erysipelas (1), diphtheria (1) and measles (1). There were quite a few bronchial fistulas and one chronic empyema. The average duration of drainage for these closed cases was 46 1/2 days which included 3 long cases respectively 180, 100 and 330 days. This duration is 4 days higher than the rib resection and can probably be explained by the poorer condition of the patients and the greater number of complications. It has been repeatedly noticed that an empyema no matter how drained, will not heal in a patient who is sick or debilitated from other cause.

Some secondary operations were required. There were 5 requiring rib resection because of unsatisfactory drainage due either to pocketing or very thick exudate. There were also 5 removals of the closed drainage tube after too early a removal. This latter can hardly be called a secondary operation. There was one decortication for chronic empyema 3 months after the secondary rib resection and resulted in a cure. There are no chronic cases now persisting.

A few words should be said about this technique. A No. 14F or No. 16F catheter with an open end and 2 side fenestrations is used. This is inserted under local anesthesia by the trocar cannula method the largest tube that will go through the cannula being used so as to give an

air tight fit in the chest wall. A length of 2 or 3 inches is allowed inside the chest. There is no necessity for dependent drainage though the tube is usually put into the lower part of the cavity. The greatest care is taken not to allow any air to enter the chest during the treatment. The pus is removed gradually, attempt not being made to remove all at time of operation unless the total amount is small. If the patient begins to cough during withdrawal of pus, normal saline is injected until the annoying irritation has stopped. It usually takes about 48 hours before all the original pus is withdrawn. From then on we use some form of suction and irrigation. Usually the cavity is irrigated two or three times in 24 hours with Dakin's solution until the fluid returns clear. In addition to these irrigations the usual plan is to instill a small amount of Dakin's solution every 3 hours, first withdrawing the accumulated secretion. Suction is kept up by this frequent aspiration of the secretion with clamping of the tube while pressure is still negative or by connecting the drainage catheter to a long tube full of water running into a half filled bottle on the floor, the latter giving a constant pull equal to the weight of the column of fluid reaching from the bed to the floor. The aim in this treatment is first to keep up a constant negative pressure and consequent pull upon the lung and second to keep the slowly shrinking cavity continually bathed in Dakin's solution which not only destroys organisms but also gradually dissolves thickened secretion and fibrin. The element of suction of course is lost when bronchial fistula is present. There is no absolute rule to tell when a tube may be removed. The patient should be in good condition, the drainage must be practically clear and success is most likely if the cavity holds one half ounce or less. I have not recently used the microscopic bacterial count.

This method sounds a little simpler than it really is. There is often great difficulty in getting this pus out through a catheter in the early stages and for the first few days one must sometimes give freely of time and patience. It is practically impossible to leave these cases to an interne or nurse unless carefully watched because through inexperience or lack of time they will fail to keep these tubes running freely and frequently leave in the chest more of Dakin's solution than they remove of secretion. One nurse experienced in this form of treatment is of inestimable value. This difficulty was present in only a few of the cases. The others gave no trouble at all and very few of the cases were hard to manage after the first week.

most powerful argument against early operation even though two of these cases were treated by aspiration alone. Wilensky reported a lessening of mortality with each week that operation was deferred up to the seventh and eighth week from the beginning of the disease after which the mortality showed a rapid rise. Most clinics realize now the value of delay and the old plan of early diagnosis and emergency operation has been completely discarded. The terrific mortality figures given by writers only a few years ago are probably largely the result of early operative treatment. Whenever possible no operation should be done until the active pneumonia has completely subsided. If it is feared the patient is suffering from fluid pressure or toxic absorption, aspiration alone in moderate amounts should be practiced until the lung is clear of consolidation.

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EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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AUGUST 1931

THE HOSPITAL INTERNE— EMBRYO SURGEON

NO interne should expect to become a surgeon merely from the training secured during a 1 or 2 years hospital service but that there is such a tendency is becoming increasingly apparent. Many men are limiting themselves to a one year's hospital residency before entering upon surgical practice feeling that they receive sufficient training in this brief space to justify their attempting the specialty of general operative surgery. It is obvious that such a thing is being encouraged by certain staff members who have the direct responsibility of the intern's teaching. In a recent survey it was found that 53 per cent of the internes in our American hospitals are permitted to do major surgery the report stating that some of the operations described would seem to require more mature skill even though the work was performed under strict supervision. That a majority of our internes are allowed to perform major surgery even under supervision at first glance is surprising if not alarming.

One must agree with the opinion expressed in this report that the idea apparently growing that internes are in hospitals primarily to acquire surgical technique and become surgeons without additional graduate preparation in that subject should be discouraged. As a distinguished teacher recently said the operating room serves as a laboratory in which the clinical and pathological pictures are correlated rather than a laboratory where surgical technique is demonstrated.

A working knowledge of technical surgery is a difficult thing to acquire necessitating much time and patience and far more experience than can be obtained in the usual few months surgical routine of a 1 or even 2 years rotating service and by the same token and what is even more important surgical judgment is acquired only after years of practical experience. One can not train surgeons as we used to train children to swim by throwing them into the water but that such short cut methods are being too extensively utilized is manifested by the appalling number of unnecessary operations which are usually badly done and on the most meager provocation or no provocation at all. Such operations are performed throughout the country largely by young men who have set themselves up as general surgeons after the most superficial and incomplete training. A serious responsibility rests on that hospital whose organization is so loosely supervised that its internes are encouraged to delude themselves into believing that they may become competent surgeons after such brief and sketchy operating experience. Such gross disregard of the welfare of the patient as well as of the good name of surgery

CONCLUSIONS

The mortality of 6.25 per cent is extremely low one of the lowest reported. Of course it must be remembered that the mortality of empyema is the mortality of the accompanying pneumonia and of its complications. As we are reporting here only treated cases of empyema the great majority are those that have survived the pneumonia so consequently many of the fatal cases reported in some statistics do not fall in this category.

The greatest single factor influencing mortality was the time of operation—no case died that was operated upon after the pneumonia had subsided and the pus had become thick. Apparently greater operative interference than aspiration is inexcusable in the presence of pneumonia and even then aspiration should be done only for pressure.

Age will always remain a factor in the mortality, the younger the patients are up to 3 years the higher the number of deaths. Temperature and white blood count should not be considered as of prognostic importance.

As to the type of operation this series is too nearly a series of closed drainage to give a good comparison of the three types. Certain impressions may be worth mentioning.

Aspirations are of greatest value in removing early fluid which causes embarrassment from pressure. It is more likely to be curative in small effusions particularly in infants. If cure is not apparent after two or three aspirations I believe time and probably risk are lessened by establishing better drainage.

Open drainage or rib resection undoubtedly gives the most efficient evacuation of pus when accompanied by irrigations. The frequent washing out of these cavities with Dakin's solution cannot fail to help the mechanical drainage tremendously besides having an antiseptic and solvent action on the secreting membrane. The objection to open drainage is of course lung collapse and it should be saved for late cases

preferably moderate sized cavities with encapsulation. In the late cases with tremendous effusion primary closed drainage for a period will allow some lung expansion and encapsulation before rib resection.

Closed drainage apparently meets its greatest indication in children. Cavities are smaller than in adults, radical operation is a greater ordeal and depending upon treatment lung collapse or lung expansion occurs much more readily. A method of using negative pressure and antiseptic action theoretically offers the ideal treatment. The practical drawback is of course difficulty in keeping up efficient drainage the first week. If one is willing to give the time and personal attention necessary for this treatment I believe it is the best for the average child's case. If he cannot for reasons of time or distance keep this drainage free I would recommend aspiration longer and then dependent rib resection with irrigation.

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AUGUST 1931

THE HOSPITAL INTERNE— EMBRYO SURGEON

NO interne should expect to become a surgeon merely from the training secured during a 1 or 2 years hospital service but that there is such a tendency is becoming increasingly apparent. Many men are limiting themselves to a one year's hospital residency before entering upon surgical practice feeling that they receive sufficient training in this brief space to justify their attempting the specialty of general operative surgery. It is obvious that such a thing is being encouraged by certain staff members who have the direct responsibility of the intern's teaching. In a recent survey it was found that 53 per cent of the internes in our American hospitals are permitted to do major surgery the report stating that some of the operations described would seem to require more mature skill even though the work was performed under strict supervision. That a majority of our internes are allowed to perform major surgery even under supervision at first glance is surprising if not alarming.

One must agree with the opinion expressed in this report that the idea apparently growing that internes are in hospitals primarily to acquire surgical technique and become surgeons without additional graduate preparation in that subject should be discouraged. As a distinguished teacher recently said the operating room serves as a laboratory in which the clinical and pathological pictures are correlated rather than a laboratory where surgical technique is demonstrated.

A working knowledge of technical surgery is a difficult thing to acquire necessitating much time and patience and far more experience than can be obtained in the usual few months surgical routine of a 1 or even 2 years rotating service and by the same token and what is even more important surgical judgment is acquired only after years of practical experience. One can not train surgeons as we used to train children to swim by throwing them into the water but that such short cut methods are being too extensively utilized is manifested by the appalling number of unnecessary operations which are usually badly done and on the most meager provocation or no provocation at all. Such operations are performed throughout the country largely by young men who have set themselves up as general surgeons after the most superficial and incomplete training. A serious responsibility rests on that hospital whose organization is so loosely supervised that its internes are encouraged to delude themselves into believing that they may become competent surgeons after such brief and sketchy operating experience. Such gross disregard of the welfare of the patient as well as of the good name of surgery

can not be too severely condemned. The question of badly performed and unnecessary surgery is even far more serious today than it was in 1836 when Gross said "so long as God shall give me strength I shall not cease to raise my voice and to exert my humble influence against the indiscriminate senseless employment of the knife so prevalent at the present day in this country."

The interne planning to go into surgery or into any major specialty for that matter requiring a high degree of technical training manual skill and sound judgment should consider the 1 or even 2 years service purely as an important and essential period of preparation before pursuing further and more intensive study in an institution dealing largely with that branch of medicine in which he is especially interested and to which he plans devoting his life—an institution in which he is prepared to devote several years of loyal apprenticeship to an older man or group of older men who because of their long experience and proved ability are justified in being considered masters of their profession. Surgery must not be taken up lightly by the student but only after due deliberation and careful planning and then only after a firm resolve to which he devoutly and persistently adheres that he will never consent to perform a major operation upon a fellow human unless in the greatest emergency or under the closest supervision until he has as the result of long and thorough self-sacrificing study become fully competent to assume that greatest of all personal responsibilities. HAROLD L. FOSS

EMBOLECTOMY

IT has been the history of most operative procedures that once evolved their subsequent application and the resultant evaluation of their efficacy did not become

possible until the indications and type of case for which the procedure was intended became well known. Such an operation is embolectomy for embolic occlusion of large peripheral arteries. Pemberton in a recent article has very aptly stated: "There is no established operative procedure of equal simplicity fraught with so little risk and with such dramatic potentialities that has been so woefully neglected as embolectomy for circulatory disturbances of the extremities."

In reading Scandinavian surgical literature one is impressed by the numerous report of successful cases of embolectomy. These have followed upon the excellent work of Key who has called to the attention of the medical public the excellent results which attend prompt surgery in arterial embolic occlusion.

The diagnosis of embolic occlusion is not difficult especially if one has the condition in mind and if the patient has been suffering from a condition which might give rise to emboli. With the lodgment of an occluding embolus there occurs a sudden sharp pain in the affected extremity followed by increasing difficulty in movement. On examination there is absence of pulsation in the vessel distal to the occlusion, blanching of the skin and lowered temperature.

The emboli arise from thrombus formation in the left side of the heart. Less commonly they arise from the aorta or its great branches. Factors favoring thrombosis are stasis, infection or injury to the endothelium. Stasis is probably the most frequent cause associated with sluggish circulation in the recesses of the heart particularly the auricles and their appendages. Such a condition exists in mitral stenosis particularly with chronic fibrillation and dilated auricles. Thrombi may form however in any dilated heart especially in the presence of congestive heart failure. Emboli frequently occur as a result

of the cardiac derangement which accompanies exophthalmic goiter especially in the presence of auricular fibrillation. The friable verrucous vegetations which accompany infection of the valves in endocarditis are frequently detached and thrown into the circulation. Infarction of the heart muscle as occurs in coronary occlusion may be followed by mural thrombi. Endothelial injury from arteriosclerosis or syphilis may give rise to emboli.

When it occurs embolic occlusion is the occasion for prompt surgery. Its emergency nature should be emphasized. The chances of

re-establishment of circulation by embolectomy are directly proportional to the time elapsed from the time of lodgment to its removal.

As mentioned previously the successful work of Key has shown that the occasions for the use of the operation are more frequent than has been apparent in this country. When the indications for its employment are well known and its emergency nature understood there is little doubt but that it will be the means of saving many limbs of which amputation would otherwise be inevitable.

ROBERT L. MASON

MEMOIRS

JOHN OSBORN POLAK

Born March 1, 1870—Died June 9, 1931

IN the passing of John Osborn Polak the American College of Surgeons shares with the medical world the loss of one of the great gynecologists and obstetricians of our day. He was a Founder and Life Member of the College a Governor 1913-16 and 1926-31 and a Regent since 1927.

During eighteen years since the organization of the College he was active in its work. He aided in formulating its ideals in its vision and support of the scientific specialist in surgery in its effort to better the environment of surgical practice in its practical research and in its stand for ethical transactions among physicians and surgeons.

Doctor Polak was wise in counsel and he was uncompromisingly for safe administration. He was an ardent supporter of our partnership with the public and ungrudgingly gave of his time at our annual congresses and at our numerous sectional meetings throughout the United States and Canada so many of which he attended.

The officers, Regents and administrators of the College will miss his friendly greeting, his companionable spirit and his staunch advocacy of those things that are right.

This friend so suddenly and prematurely taken away was ever loyal to the past, confident of the present and trustful for the future. He possessed great strength of character and many fine human attributes. It is difficult to realize that our personal friendship of many years has ended. FRANKLIN H. MARTIN

DOCTOR POLAK was born in Brooklyn, New York, home of four generations of his family, on March 12, 1870, the son of Karl T. and Mary E. (Osborn) Polak. In 1896 he married Bertha L. Pitkin of Brooklyn, who died in 1924. There is one daughter, Mary Osborn Polak.

He received his early education in the public schools of New Brunswick, B. Sc. Rutgers College in 1889, M. D. Long Island College Hospital and University of Vermont, 1891, at which time he received the Dudley Medal for Surgery. M. Sc.



Mr. John D. Hall

Rutgers, 1901, interne Long Island College Hospital 1891-92 resident Midwifery Department, New York Postgraduate 189-93, instructor in histology and obstetrics, Long Island College 189-95 instructor in obstetrics New York Postgraduate, 1894-98 adjunct professor 1898-1901 professor of obstetrics 1901-7, assistant professor of obstetrics and gynecology Long Island College 1900-1910

In 1900 he succeeded the late Dr Paul Munde as professor of obstetrics and clinical professor of gynecology Dartmouth Medical School serving for ten years He succeeded the late Dr Charles Jewett as professor in the department of obstetrics and gynecology in the Medical School of Long Island College Hospital in 1912, and on March 26 last was elected president of the Board of Regents of the hospital chief obstetrician and gynecologist Long Island College Hospital 1911, attending gynecologist Williamsburgh Hospital 1894-1906 Brooklyn E D Hospital 1896-98 Jewish Hospital Brooklyn 1906-22 Deaconess Hospital, 1899-1907, People's Hospital New York 1900-1 chief gynecological department, Polhemus Clinic 1899-1910, obstetrician Methodist Episcopal Hospital 1906-14, director, department of obstetrics and gynecology Israel Zion Hospital 1924-29 consulting gynecologist Jewish Israel Zion Caledonian Bushwick Coney Island and Southampton Hospitals consulting obstetrician, Methodist Episcopal Mary Hitchcock and Nyack Hospitals

Fellow Royal Academy of Medicine (Ireland) member American Gynecological Society (councilor 1921 vice president 1924) American Association of Obstetricians Gynecologists and Abdominal Surgeons (president 1917) New York Obstetrical Society (president 1916) Brooklyn Gynecological Society (president, 1910), American Medical Association (chairman section on obstetrics 1921) New York Academy of Medicine New York State Medical Society Medical Society County of Kings (president 1915) Long Island Medical Society, Associated Physicians of Long Island Brooklyn Medical Society, Williamsburgh Medical Society Brooklyn Pathological Society

Collaborator, Keating and Coes Gynecology 1894 and Text Book of Obstetrics by American authors 1906, author Manual of Obstetrics 1913 and 1922 Students Manual of Gynecology, 1915 1922 and 1917 Pelvic Inflammation in Women 1921 and 1931 Also author of many scientific articles pertaining to original work in his specialties

Editor, Department of Obstetrics INTERNATIONAL ABSTRACT OF SURGERY, member, Editorial Boards of the *American Journal of Surgery* and the *American Journal of Obstetrics and Gynecology* and chairman of the Sub committee on Parental, Maternal and Early Infant Care of the White House Conference on Child Health and Protection

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

ALFRED BROWN M.D. F.A.C.S. OMAHA

THE SURGERIES OF CHARETANUS

But no means the least interesting of the old surgical works are those that we know little or nothing about. Perhaps as surgical milestones they may not be particularly important. Perhaps here and there they may contain a bit of surgical knowledge or procedure which is new for the time. Perhaps they may contain a bit of the state of medicine which may be a little quaint or interesting as showing the author's canniness in one of the books of Charetanus, given a valuable recipe by the use of which one may lengthen his life fifteen years but then is added if it is not against the will of God. The authors of many of these interesting books are not all known. In fact we know and can find out little about them. Consequently they represent a question mark in history which leads to a puzzle which is at least alluring to the student of surgical history.

The surgeries of Charetanus appeared during the second quarter of the sixteenth century. They are small books of only a few pages and appeared in several forms. One accord given to Gurlt was printed in Strassburg in 1530 and later reprinted in Frankfurt in 1549 and 1552. It bears as its title *Wound Surgery* for all wounds of the entire body and especially of each member with what may occur and is necessary for the wound surgeon to know. Many excellent prescribed medicines, advices and masterpieces of the very learned surgeon Joannus Charetanus. The correct art and instruction for bloodletting. For the bloodletter and barber. A second printing of this work by H. Guelfferich appeared in 1549 and a later edition enlarged to thirty-six pages appeared in 1555. An editio bearing practically the same title but differing in arrangement of material and illustrations was printed by Chr. Egenolph in 1531. On the title page it reads *Zu Strasburg Chr. Egen. and at the end the colophon reads* Zu Frankfort im Jenner/des 12ars 1531 so whether printed in Strassburg or Frankfurt it is hard to say. A third form noted by Gurlt was printed by Chr. Egenolph at Frankfurt am Meyn in 1534 and the names of Lanfrancus and Laurentius Fries are added to the title.

This series of surgeries represents the first surgeries printed in German. It fits the works of Jean of Brunschwig and Hans von Gersdorff in the latter part of the 15th and early part of the 16th centuries

and the work of Fries more medical than surgical which was first printed in 1518. As to the author Joannus Charetanus little is known of him under that name. A man named Johannes de Karthannatione almanus is referred to by Champier in his *De medicis claris scriptis* which gives a clue to a German named Karthann who practised surgery. Sudhoff in his *Kellam* (Monumenta Medica Sigrist R. Lier & Co 1923) refers to this Johannes Karthann and believes the name which was spelled in many forms—Karthann, Karchann, Karthann, etc. were variants of the name of Johannes of Kirchheim, a physician and surgeon of the latter half of the fifteenth century who was professor of medicine and surgery at the University of Vienna. The name of this man was also spelled Kirchheimer. From Karthann to Charetanus is not a very long jump when one considers the many variant spellings in vogue when this man lived and the translation of the name from the vernacular into Latin. Especially when it is rather assumed that this man is Johannes of Kirchheim, is probably also known as Johannes de Ketham, the author of the *Fasciculus Medicus* Venice 1491. The likelihood that three names Ketham, Kirchheim, and Charetanus were used for the same man is the fact that certain parts of the surgical sections of these small surgeries of Charetanus of the sixteenth century correspond identically with similar corresponding sections in the *Fasciculus Medicus* of Johannes de Ketham of the fifteenth century, the later German text being a translation of the earlier Latin.

The most interesting parts of these small surgeries are the illustrations which differ in the two editions. In the edition of 1539 the title page shows some dental instruments and the cuts are reproduced later in the part of the book dealing with that subject. The main illustration is a slightly altered woodcut of the bloodletting mannikin of Fries which is carefully labelled. Contrafacter Lassman, to let every one understand that the dissection represents the body of a criminal. There is also a smaller cut of a zodiac man showing the trunk dissected. In the 1531 edition the man of Fries is omitted and is replaced by a smaller different cut and a woodcut of a physician performing uroscopy is added.

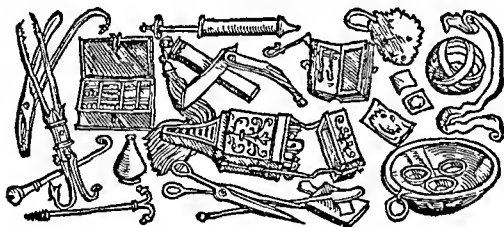
Either these works of Charetanus give an excellent idea of the character of the popular small surgical textbook of the early sixteenth century

Wundartzney:

Zu allen Gebrechen des gantzen Leibs/
Vnd zu jedem Glied besonder/ Mit was zufällen die ent-
sehn/ Vnd dem Wundartz zu kommen indgen Viledley/bewarter Arz-
neien/Rath vnd Meysterstück. Des vñ
erfahrenen Chirurgen

IOANNIS CHARETANI

Rechte Kunst vnd Bericht der Alderläß.
Für die Alderläßer vnd Scherer



Zu Straßburg Chr Eg

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

ALFRED BROWN M.D. F.A.C.S. OMAHA

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in relation to the differential diagnosis of abdominal tumors Schmidt writes on the relation of the cellular histology of uterine carcinomata to irradiation therapy and discusses the various stages of reaction which are essentially phagocytic and lytic processes. Lahm discusses very fully the foundation of biologic healing of cancers. Meyer and Schmidt consider the stomach after operation and discuss the anatomy and physiology, the relation of surgical attack on these functions, the technique of diagnosis, the various methods of operations and the undesired results of operations. Luedcke presents a short monograph on the use of diathermy in oral, rhinal and laryngeal diseases, discussing the physics of diathermy and describing the apparatus and technique of medical and surgical diathermy and the therapeutic indications and results.

Each monograph represents the up to the minute attainments in each subject. The perusal of the volume was an actual treat. HENRY SCHMITZ

THE monograph on *Der operative Magen* deals with roentgenologic observations made by the authors in 400 postoperative gastric cases. The greater number of these were operated upon for gastroduodenal ulcer, a few for carcinoma of the stomach or for peptic jejunal ulcer. The material came from the surgical clinic of Prof. Stich in Goettingen.

The authors stress the point that not enough attention has so far been paid to roentgenologic studies in the follow up of postoperative gastric cases. They feel that much can be learned by early observations. They have begun their studies as early as the tenth day after operation.

The monograph deals rather extensively with the physiology of the normal gastro-intestinal tract as well as with the modifications resulting from operative interventions. Attention is paid to changes in form and position of the stomach operated upon as well as in the motor and digestive function. Practically every type of operation is included.

The authors emphasize the fact that the gastro-enterostomy stoma is more than a drainage hole. Partly through cicatricial narrowing and partly through muscle hypertrophy the stoma learns to act more or less like the pylorus so that the emptying is not continuous but is interrupted and rhythmic. They do not however believe that a true sphincter is formed.

In their discussion of the much dreaded early complications such as the acute dilatation of the stomach, the so-called arterioenteric obstruction of the duodenum of the vicious circle and the paralytic ileus of the stoma, the authors advanced the view that the older conception of an actual mechanical obstruction is only exceptionally true. In their opinion the condition is most often a functional spastic one. They are in agreement with Reischauer who first explained this phenomenon

and termed it stomach bowel block. The spasmodic contraction begins in the bowels and spreads to the anastomosis or to the duodenojejunal flexure.

The monograph contains much of interest to the surgeon and the roentgenologist. GEO. HALPERIN.

THE two classical works on operative gynecology—Kelly's in this country and the one by Doederlein and Krönig in Germany—will have to look to their laurels now that the book by Peham and Amreich of Vienna has appeared.

This volume, which by its unusual shape and size as well as by its general makeup at once creates a distinguished and favorable impression, is divided into three sections. In the first all those factors are discussed which make for greater success of gynecological operations, namely the routine before and after operation, prevention of infection and other postoperative complications, treatment of bleeding, technique of the various abdominal incisions, etc.

The entire second section is devoted to the topography of the contents of the female pelvis. The pelvic connective tissue which includes the loose tissues as well as the fasciæ, its relation to blood vessels and nerves, the lines of cleavage, the lymphatics, ureter, rectum and bladder in short all structures that he must know who aims at proficiency in pelvic operations are demonstrated in large colored drawings of admirable perfection. In preparing these numerous dissections the authors found that several structures which from a purely anatomical standpoint had no importance and carried not even specific names were quite significant as far as operative technique was concerned.

The last and largest part of the work deals with the various gynecological operations, in particular the order of the operations described differs markedly from that in other books on operative gynecology. The operations for cancer of the uterus are given first place because it embraces practically all the details of topography and technique with which the gynecologist is concerned. Thereby the authors hoped to avoid unnecessary repetitions. It is quite clear that vaginal hysterectomy for cancer of the cervix is their favorite method and is very comprehensively described. The abdominal radical operation is given far less space though the descriptive and pictorial representation is quite adequate.

The succeeding chapters deal with operations for fibroids, ectopic pregnancy, adnexal tumors, tuberculous ovarian growths, all sorts of plastic operations, etc. All these chapters are equally profusely and equally admirably illustrated.

One would need much more space than the editor is likely to allow to do full justice to this magnificent and monumental work which embodies an immense amount of hard labor of serious and valuable research and of attention to the minutest detail. A harsh fate carried Peham off before the book

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

C. JEFF MILLER *New Orleans President*

ALLEN B. KANAHEL *Chicago President Elect*

FRANKLIN H. MARTIN *Director General*

CHARLES GORDON HEYD *Chairman New York Committee*

JOHN E. JENNINGS *Chairman Brooklyn Committee*

PLANS FOR THE NEW YORK-BROOKLYN CLINICAL CONGRESS

UNDER the supervision of a representative committee of surgeons of New York and Brooklyn there is being prepared a program of clinics and demonstrations in the hospitals and medical schools for the twenty first annual Clinical Congress of the American College of Surgeons October 12th to 16th. The preliminary clinical program which appeared in the June issue of this journal and which will be published in revised form in the September issue will be further revised and amplified during the weeks preceding the Congress in order to present a more complete outline of the clinical work that will be demonstrated. The clinicians of greater New York are keenly interested in providing for the visiting surgeons a complete showing of the surgical activities of that great medical center a program that will include all branches of surgery—general surgery, gynecology, obstetrics, orthopedics, urology, proctology and surgery of the eye, ear, nose, throat and mouth.

Clinics are scheduled for Monday afternoon beginning at 2 o'clock and for the mornings and afternoons of each of the four following days. One recalls that at three previous sessions in that city most attractive clinical programs were presented and we have the confident assurance of the committee on arrangements that in point of scientific interest this year's Congress will surpass previous sessions.

Wednesday has been designated as Brooklyn Long Island Day and for that day the committee is preparing a special program of clinics in the hospitals of that borough which will include many interesting features.

A series of fracture clinics demonstrating modern methods in the treatment of fractures constitutes a special feature of the clinical program.

The committee is arranging for a comprehensive showing at several of the larger hospitals of the methods employed and the results obtained in the treatment of fractures which form so large a part of the surgical work in our large cities.

Among the important features of the clinical program will be demonstrations in the treatment of cancer by surgery, radium and X-ray, rehabilitation by surgery and physical therapy of patients injured in industrial accidents.

The real program of the Congress will be issued daily in the form of bulletins that give a complete accurate and detailed schedule of the clinics to be given at each of the hospitals. These bulletins will be posted at headquarters each afternoon for the following day and printed bulletins containing the same schedules will be distributed each morning.

EVENING MEETINGS

Programs for a series of five evening meetings are being prepared by the Executive Committee of the Congress. At the Presidential Meeting on Monday evening following the introduction of distinguished guests from abroad and the inaugural address of the president elect Dr. Allen B. Kanael of Chicago, the John B. Murphy oration in surgery will be delivered by Mr. Arthur H. Burgess, M.B., F.R.C.S., Manchester, England, professor of clinical surgery in Victoria University, Manchester, England, and president of the British Medical Association.

The annual fracture oration will be delivered by Professor William Darrach of Columbia University. His subject will be "Some Old Truths about Fractures."

Among the distinguished visitors from abroad is Sir Charles Gordon Watson, K.B.E., C.M.G.

Organizing a Service for the Diagnosis and Treatment of Cancer in an Approved Hospital (illustrated) BOWMAN C CROWELL M D Chicago
 Responsibility of the Fellows of the College in Promoting the Hospital Standardization Program SOUTHGATE LEIGH M D Norfolk Va
 The Soul of the Hospital REV ALPHONSE M SCHWITTALLA SJ Ph D St Louis
 Our Challenge How Shall We Meet It? PAUL H FESLER Minneapolis
 General discussion opened by GEORGE W CRILE M D Cleveland

2 00 PM - 5 00 PM

Significance of the Seemingly Insignificant Matters in Hospital Management DONALD GUTHRIE M D Sayre Pa
 Importance of More Adequate Sterilization Processes in Hospitals WALTER E DANDY M D Baltimore
 Present Status of Hospital Costs and Charges—Report of a Nation Wide Survey JOHN A McNAMARA Chicago
 The Staff Conference Which Assures a Thorough Review of the Clinical Work and Maximum Benefit to the Medical Staff and Hospital (illustrated) ALTON W OCHSNER M D New Orleans
 Important Factors in Assuring Efficient Nursing Care of the Patient JANET F KORNOLD RN New Orleans

Tuesday—9 30 A M - 12 00 A M

Open forum conducted by ROBERT JOLLY Houston Texas
 The Present Economic Depression in Hospitals—Increasing the Utilization of Hospital Facilities—Maintaining the Balance Between Economy and Efficiency C J CUMMINGS Tacoma Wash
 Avoiding Pitfalls in Hospital Administration—Stop Look Listen! A J SWANSON Toronto
 Administrative and Medical Problems Associated with the Open Hospital FRANK J WALTER Denver
 What Shall We Do About Automobile Accidents?—Report of a Nation Wide Survey MATTHEW O FOLEY Chicago

2 00 PM - 5 00 PM

Conference on Medical Social Service and Follow Up
 The General Organization and Scope of Social Work in Medical Institutions A Plan for Efficient Follow Up of Discharged Patients Medical Social Work in Industrial Medicine and Traumatic Surgery Medical Social Service as Applied to the Cancer Patient

3 0 A M - 10 00 A M

Our Responsibility as Trustees F L BRAMAN Torrington Conn
 Promoting a Better Understanding Between the Superintendent Trustees and Medical Staff CHARLES F NEERGAARD Brooklyn
 By What Criteria Can the Trustees or Governing Body Judge the Efficiency of Their Institution? S S GOLDBLUM M D New York
 Factors to be Considered in the Cost of Medical Care from the Standpoint of the Hospital WILLIAM H WALSH M D Chicago
 What Do Hospital Trustees Expect from Their Superintendent? J ALLEN JACKSON M D Danville Penn

Wednesday—9 30 A M - 12 00 A M

How Can Scientific Clinical Records Be Assured (illustrated) JAMES T NIX M D New Orleans

A Check System for Current Case Records DOROTHY GILMAN Seattle Wash
 A Plan for Making Group Studies of Diseases (illustrated) PAUL W WILLIAMS M D Grand Rapids Mich
 A Complete System of Departmental Daily Reports Essential in Efficient Hospital Administration WILLIAM I LACY Cleveland
 General discussion opened by THOMAS R PONTON M D Augusta Ga

2 00 PM - 3 30 PM

Round Table Conference—Medical and Nursing Problems Conducted by R C BUERKI M D Madison Wis
 Round Table Conference—Administrative and Economic Problems Conducted by ROBERT JOLLY Houston Texas

Brooklyn—Thursday—9 30 A M - 12 00 A M

Demonstration and round table conferences conducted by MALCOLM T MACEachern M D Chicago and ROBERT JOLLY Houston Texas Procedure in admitting and discharging patients organization and management of the case record department nursing administration and service operating room management and procedure organization and management of the interne service

2 00 PM - 4 00 PM

Demonstration and round table conference conducted by ROBERT JOLLY Houston Texas and MALCOLM T MACEachern M D Chicago Organization and management of the dietary department and food service business methods in hospitals management of the obstetrical department handling of hospital visitors public relations

REDUCED RAILWAY FARES

The railways of the United States and Canada have authorized reduced fares on account of the New York session of the Clinical Congress so that the total fare for the round trip will be one and one half the ordinary first class one way fare To take advantage of the reduced rates it is necessary to pay the full one way fare to New York procuring from the ticket agent when purchasing ticket a convention certificate which certificate is to be deposited at headquarters for the signature of the general manager of the Clinical Congress and the visé of a special agent of the railways Upon presentation of a viséd certificate to the ticket agent in New York not later than October 20th a ticket for the return journey by the same route as traveled to New York may be purchased at one half the one way fare

In the eastern central and southern states and eastern provinces of Canada tickets may be purchased between October 8th and 14th in other sections of the United States and Canada at somewhat earlier dates The return journey from New York must be begun not later than October 20th

The reduction in fares does not apply to Pullman fares nor to extra fares charged for passage

FRCS of London England who will speak on Some Experiences in the Treatment of Carcinoma of the Rectum with Radium

Other speakers at the evening meetings with the titles of their papers are George W Crile M D Cleveland Technique and End Results in Denervation of the Adrenal Glands Arthur M Shipley M D Baltimore The Operative Approach to the Heart and Pericardium Elliott C Cutler M D Cleveland The Present Status of Cardiac Surgery Ralph Pemberton M D Philadelphia The Newer Concept of Chronic Arthritis William R Cubbins M D Chicago

Repair of Knee Joint Injuries Received by a Lateral Impact of Extended Leg

At the annual convocation of the Congress on Friday evening the 1931 class of candidates for fellowship in the College will be received The presidential address will be delivered by Dr Kanavel

Special meetings of the sections on ophthalmology and otolaryngology of the New York Academy of Medicine have been arranged for Tuesday and Wednesday evenings at the Academy at which papers of interest to those who practice these specialties will be presented by a number of outstanding American ophthalmologists and otolaryngologists

FEATURES OF THE PROGRAM

Important features of this year's Congress include a cancer symposium under the auspices of the Committee on the Treatment of Malignant Diseases on Thursday afternoon following the annual meeting and a session on Thursday forenoon devoted to a consideration of the essentials in the organization and administration of cancer clinics throughout the country under the guidance of the College

An all day conference on traumatic surgery under the auspices of the Board on Traumatic Surgery and Industrial Medicine is being arranged for Friday at which leaders in industry and labor representatives of indemnity companies surgeons and hospital administrators will discuss various phases of this important activity of the College Dr Frederic A Besley chairman of the Committee will report on the work of the Committee in recent years outlining its present and future activities in respect to the nation wide survey of the medical and surgical facilities of our industries

The newer surgical films both sound and silent including some in colors will be exhibited daily at headquarters An extensive program of film contributions will be presented includ-

ing the films that have been produced under the supervision of the Board on Medical Motion Picture Films of the American College of Surgeons

HEADQUARTERS

General headquarters for the Clinical Congress will be established at the new Waldorf Astoria Hotel located on Park Avenue between 49th and 50th Streets This magnificent new hotel with more than 2 000 guest rooms which is now nearing completion and will open early in the fall affords unusual facilities for sessions of the Clinical Congress The grand ballroom and other large rooms and foyers on the second floor of the hotel have been reserved for the exclusive use of the Congress for scientific meetings conferences film exhibitions registration and ticket bureaus bulletin boards executive offices scientific and technical exhibitions etc All the comforts and facilities of the old Waldorf Astoria which had been headquarters on the occasion of three previous Congresses will be found in the new hotel with many added attractions and conveniences

Space has been reserved in the Astor Gallery Jade Room and other large rooms and foyers on the second floor of the hotel adjacent to the grand ballroom for the Technical Exhibition in which will be represented the leading manufacturers of surgical instruments X ray apparatus operating lights hospital apparatus of all kinds pharmaceuticals publishers of medical books etc

HOSPITAL STANDARDIZATION CONFERENCE

For the fourteenth annual hospital conference which opens at 9 30 on Monday morning in the grand ballroom of the Waldorf Astoria an interesting program of papers round table conferences and practical demonstrations that deal with problems related to the hospital standardization program of the College has been prepared This program is planned to interest surgeons hospital trustees executives and nurses and an invitation to attend the conference is extended to all persons interested in the hospital field

Monday—9 30 AM—1 0 AM

Chairman Addes C J E F M LER M D New Orleans
Ethel Idall d Serv s Applied to the Approval
H p t l ALLEN B KANAVEL M D Chicago
P e t P o g m f t h A m e r i c a C l i g e o f S r g e o
F A N L I N H MARTIN M D Chicago
Analysis of F d g s f o m t h e 93 H s p i t l S t a d a d i z
t i n s e y (I n t r a t d) M A L C O L M T M C E A C H E R N
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o f t h I I I d I J d I n d u s t r y F R E D R C A
B S L E Y M D W u k e g a I l l

SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE PUBLISHED MONTHLY

VOLUME LIII

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NUMBER 3

LESIONS OF THE "ISTHMUS (PARS INTERARTICULARIS) OF THE LAMINÆ OF THE LOWER LUMBAR VERTEBRÆ AND THEIR RELATION TO SPONDYLOLISTHESIS

FREMONT A. CHANDLER, M.D., I.A.C.S., CHICAGO

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THE classical presentation of the subject of spondylolisthesis by Neugebauer in 1892 has served to arouse considerable interest in this subject, at first among obstetricians and more recently among orthopedic surgeons. Although there is no reason to believe that the incidence of this lesion is increasing it is evident that the clinical recognition is becoming more common for the isolated report of this type of case is now being supplanted by long series such as that by Meyerding, 1930. Many papers on the subject of spondylolisthesis are found in the literature, but in spite of this the high incidence does not seem to be appreciated generally.

Herbinaux is credited with reporting the first clinical observation of this lesion in the latter part of the 18th century. Kilian in 1853 termed this lesion spondylolisthesis and described it as a clinical entity. Occasional reports of this condition are encountered in the obstetrical literature of the latter half of the 19th century. After years of study and travel investigating anatomical specimens through Europe Neugebauer published his famous thesis on this subject. Prior to 1884 forty three specimens of spondylolisthetic pelvises were known; these were carefully studied and formed the basis of his paper. His classification of the etiological factors resulting in anterior slipping of the proximal vertebral

body is widely quoted and subscribed to by writers on this subject. Reference to Neugebauer's paper indicates that the developmental defects of the laminae have been unduly emphasized by many authors quoting this authority. Neugebauer writes: "However as I have said elsewhere all the results of anatomical and clinical study of the etiology of spondylolisthesis certainly oblige us in most cases to look on an injury as the cause."

In considering the influence of trauma he goes on to say: "If the entire posterior transverse span of the arch of the fifth lumbar vertebra is still in its normal place and if it is either not ossified on to the sacral articular processes or if it be it there is no elongation in the inferior lumbar articular processes from behind forwards we may then suppose a primary fracture of the interarticular portion of the arch of the fifth lumbar vertebra (no spondylolysis existing at this place). Neugebauer continues with a general consideration of the etiology. We may formulate the etiology of spondylolisthesis at the present time as follows: Olisthesis may exist—

1. On the ground of congenital lateral defect in the ossification of one or both sides of the arch of the fifth lumbar vertebra, especially in the interarticular portion of the arch (spondylolysis interarticularis congenita arcus vertebralis).

on certain trains. Local railroad ticket agents will supply detailed information with regard to dates of sale rates routes etc. Stop overs on both the going and return journeys may be had within certain limits.

Full fare must be paid from starting point to New York and it is essential that a convention certificate be obtained from the agent from whom the ticket is purchased. These certificates are to be signed by the general manager of the Clinical Congress and used by a special railroad agent at Clinical Congress headquarters in New York on or before October 15th. No reduction in railroad fares can be secured except in compliance with the regulations outlined and within the dates specified. It is important to note that the return trip must be made by the same route as that used to New York and that the certificate must be deposited at headquarters during the meeting and return ticket purchased and used not later than October 20th.

An exception to the above arrangement is to be noted in the case of persons traveling from points in certain far western states and British Columbia who will be able to purchase round trip summer excursion tickets which will be on sale up to and including October 15th with a final return limit of October 31st. The summer excursion fare is somewhat lower than the convention fare mentioned above but is available only in certain of the far western states and British Columbia. Tickets sold at summer excursion rates permit traveling to New York via a direct route and returning via another direct route with liberal stop over privileges.

LIMITED ATTENDANCE—ADVANCE REGISTRATION

Attendance at the New York Brooklyn sessions will be limited to a number that can be comfortably accommodated at the clinics. The limit of attendance being based upon the result of a survey of the amphitheaters operating rooms and laboratories in the hospitals and medical schools to determine their capacity for accom-

modating visitors. Under this plan it will be necessary for those who wish to attend to register in advance.

Attendance at all clinics and demonstrations will be controlled by means of special clinic tickets which plan provides an efficient means for the distribution of the visiting surgeons among the several clinics and insures against overcrowding as the number of tickets issued for any clinic will be limited to the capacity of the room in which that clinic will be given.

A registration fee of \$5.00 is required of each surgeon attending the annual Clinical Congress such fees providing the funds with which to meet the expenses of the meeting. To each surgeon registering in advance a formal receipt for the registration fee is issued which receipt is to be exchanged for a general admission card upon his registration at headquarters. This card which is non transferable must be presented in order to secure clinic tickets and admission to the evening meetings.

NEW YORK HOTELS AND THEIR RATES

There are many first class hotels in the Grand Central Terminal district within easy walking distance of the Waldorf Astoria the headquarters hotel. The following hotels are recommended by the Committee on Arrangements.

| | Minimum Rates per Night | Double Room |
|--|----------------------------|-------------|
| Ambassador Park Ave. and 51st St. | \$7.00 | \$10.00 |
| Berkley 115th St. and 48th St. | 6.00 | 10.00 |
| Briton Madison Ave. and 43rd St. | 6.00 | 10.00 |
| Chatham Vanderbilt Ave. and 4th St. | 5.00 | 8.00 |
| Commodore 4th St. and Lexington Ave. | 3.50 | 7.00 |
| Glendon 114th E. 52nd St. | 4.00 | 6.00 |
| Lenox 114th E. 49th St. | 3.50 | 6.00 |
| Madison 114th E. 49th St. | 3.00 | 5.00 |
| New Weston Madison Ave. and 50th St. | 5.00 | 8.00 |
| Park Lane 209 Park Ave. | 6.00 | 8.00 |
| Ritz Carlton Madison Ave. and 46th St. | 7.00 | 10.00 |
| Posseidon Madison Ave. and 45th St. | 5.00 | 7.00 |
| Sherry Lane 114th E. and 48th St. | 4.00 | 6.00 |
| Waldorf Astoria Park Ave. and 5th St. | 7.00 | 10.00 |

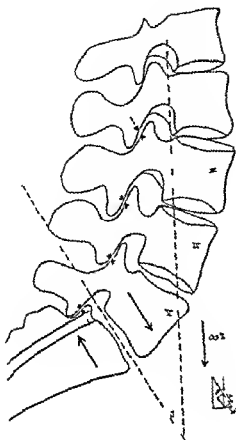
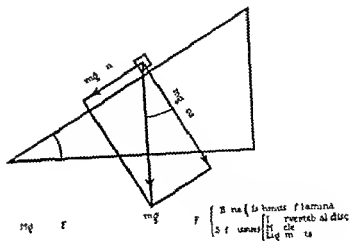


Fig 1 Diagram showing forces acting on isthmus of last lumbar vertebra



SHARING STRESS ON INCLINED PLANE

| α | $\times 100$ | P | F | C | $\times 100$ | Wt | t |
|------------|--------------|-----|-----|-----|--------------|------|-----|
| 0 degrees | 00 | 00 | 00 | 100 | 00 | 00 | 00 |
| 10 degrees | 17 | 36 | 08 | 48 | 08 | 48 | 08 |
| 20 degrees | 34 | 20 | 03 | 07 | 03 | 07 | 03 |
| 30 degrees | 50 | 00 | 86 | 60 | 86 | 60 | 86 |
| 40 degrees | 64 | 48 | 76 | 60 | 76 | 60 | 76 |
| 45 degrees | 70 | 71 | 70 | 71 | 70 | 71 | 70 |
| 50 degrees | 76 | 60 | 64 | 28 | 64 | 28 | 64 |
| 60 degrees | 86 | 60 | 50 | 00 | 50 | 00 | 50 |
| 70 degrees | 93 | 97 | 34 | 20 | 34 | 20 | 34 |
| 80 degrees | 98 | 48 | 17 | 36 | 17 | 36 | 17 |
| 90 degrees | 100 | 00 | 00 | 00 | 00 | 00 | 00 |

Fig 2 Principle of inclined plane as applied to lumbosacral region

Herrgott also took Neugebauer to task differing with him as to the etiological factors producing separation of the laminae. Herrgott contending that inflammatory changes secondary to trauma present in the interarticular region of the laminae resulted in the solution of bony continuity.

Frequent reference to vertebral caries is encountered. In this type of case the anterior displacement of the body of the fifth lumbar vertebra must be considered as secondary to the disease process. Anterior displacement due to disease of the lateral articulations must be considered as part of a secondary deformity rather than part of the disease process.

Lane maintains that the anterior displacement is the product of prolonged stress and strain and is quite normal in certain classes of workers.

In discussing the anatomy of the lumbosacral region Kleinberg says: "The forward inclination of the fifth lumbar has been assumed to be weak in its relationship with the sacrum. In a lateral view one gets the impression that

the fifth lumbar is ready to slip off the sacrum. The lumbar articular processes placed in the sagittal plane favor a dislocation. Diagnosis is established by the appearance of the fifth lumbar in the anteroposterior view. Trauma was a constant factor in the cases reported. He says: "There is no doubt in my mind that there is probably some developmental defect in the lumbosacral region affecting the body and more particularly the ligamentous structure in all cases."

In discussing conditions producing low back pain, Brackett recognizes the existence of a potential weakness of the laminae of the last lumbar vertebra and calls attention to its significance by the following:

"If the lumbosacral angle is increased which sometimes is the case to nearly a right angle, security of this joint is lessened. There may be a congenital weakness (non union cartilaginous union) in the structure of the neural arch to which the articular processes which give anchorage are attached, thus giving insecurity to the lumbosacral articulation."

2 On the ground of primary fracture—

(a) Of the sacral articular processes if the posterior transverse span of the arch of the fifth lumbar vertebra is displaced forwards and its inferior articular process exhibits a corresponding anteroposterior elongation

(b) Of the interarticular portion of the arch of the fifth lumbar vertebra if the posterior transverse span of the arch is not displaced forwards but has remained in its normal position and whether the lumbosacral joint is unkylosed or not

Neugebauer's observations were based on anatomical material which reflected the more advanced stages of spondylolisthesis. That he realized this is shown by the following. It lies with anatomists and pathological anatomists and those who make surgical and forensic postmortems to look out for the early stages of spondylolisthesis in all cases of injury from falling. If this is done I am sure that before very long commencing or advanced spondylolisthesis lumbosacralis will be commonly discovered during the examination of dead bodies at various places.

Limbl a former teacher of Neugebauer holds opinions diametrically opposed to the latter with reference to spondylolisthesis. He criticizes the work of his pupil and then goes on to discuss the etiology of the disorder.

According to his opinion primary hydrorhachis is the most important factor in the etiology primary anomaly of ossification in the fifth lumbar vertebra resulting in intra-articular schisis and lysis he looks upon as unessential. On the other hand he says intra-articular fracture of the vertebral arch has not been proved and finally the supposed fracture of the sacral articular processes is a fiction.

On the basis of his own investigations and studies to which he has devoted more than 30 years he has set up the following ten theses.

1 For correct understanding of the genesis of spondylolisthesis fetal sacrolumbar hydrorhachis is not only a plausible but a necessary prerequisite.

2 The traces of hydrorhachis can be determined in all the specimens of spondylolisthetic pelvis and hydrorhachis itself may

be used nosologically in the development of pelvic deformity.

3 The attempt at refuting the importance of hydrorhachis suffers from two evils: an excess of theoretical insufficiency and a defect of practical application.

4 Refusing to accept the theory of hydrorhachis leads to by paths in which entirely impertinent things are drawn into the realm of spondylolisthesis.

5 The expressions spondyloschisis and spondylolysis are not synonyms nor are they of the same importance as olsthesis and for this reason they must not be confused either with one another or with spinal fractures or with fracture like encroachments which may occur in connection with elongation from traction and atrophy from pressure in the vertebral arch. Unless these precautions are followed with reference to terminology there will be hopeless confusion.

6 The rudimentary interposed vertebra which 30 years ago was described and pictured in two spondylolisthetic pelvises will be of historical importance in the future also; no amount of disputation can obliterate its existence.

7 So-called congenital spondylolisthesis is an invention of the lazy brain whose non-existence may be proved without any particular effort.

8 A fracture of the intra-articular portions of the fifth lumbar vertebra and resultant olsthesis have up to the present never been determined in a single case.

9 An attempt at explaining spondylolisthesis by a quick movement or any sort of traumatic intervention rests upon a basically false conception and upon insufficient knowledge of the museum specimens.

10 A supposed fracture of the sacral articular processes represented as an etiological factor of spondylolisthesis is to put it mildly a piece of anatomical nonsense.

The above ten theses the author says will be proved by a study of the specimens and in large part by statements taken from Neugebauer's own work. In defense of his position the author shows the enthusiasm of a crusader closing with the quotation: Out of thine own mouth do I judge thee etc. Luke xiv 2.



FIG. 5. Posterior view of third fourth and fifth lumbar vertebrae



FIG. 6. Lateral view of third fourth and fifth lumbar vertebrae

duction of spondylolisthesis are present only at the lumbosacral joint. His cases ranged from 13 to 63 years of age with over one half in the third decade. In 3 of 27 cases trauma was a definite etiological factor in the production of this slipping. Backache was the chief complaint in 93 per cent.

Asbury discusses the gradual development of the surgical treatment but does not describe the treatment he employed in his series. He does not state his observations regarding the incidence of lesions of the isthmus.

In discussing Dr Asbury's paper Dr John Dunlop states: "We have operated in 19 cases of this nature at the Los Angeles General Hospital and in addition to these congenital malformations every one of these cases enabled us by operation to demonstrate fractures of the lamina. We did fusions in all cases."

Probably the longest series of cases of spondylolisthesis treated operatively were studied by Hibbs and Swift.

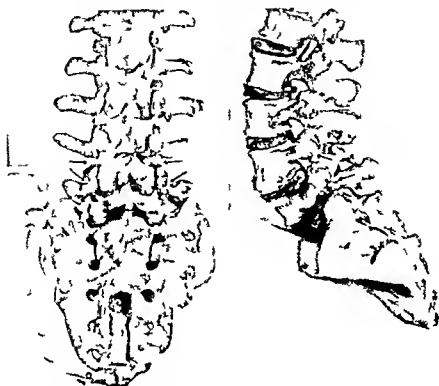
In reporting 3 cases showing forward displacement of from one-quarter inch to the full width of the body of the fifth lumbar they state: "There was found uniformly to be a separation of the laminae of the fifth lumbar

from its pedicles at a point dorsal to the superior facets so that there was no bony anchorage to prevent the body of the fifth lumbar with the superimposed spine from slipping forward. This is believed to be a congenital defect and it seems obvious that an operation which will produce strong bone fusion between the fourth or third lumbar vertebra and the sacrum is the logical procedure to employ in order to give stability to such a spine. The average age of his cases was 39 years: males 13, females 8. A positive history of injury preceding the onset of symptoms was given in 45.8 per cent."

The higher incidence of pseudarthrosis in this group is explained by the pathology which makes the operation (Hibbs fusion) a good deal more difficult than usual and necessitates most meticulous care in the dissection and transportation of bone. It is believed that even in these cases a bone graft is unnecessary. Results of operation have been good in 79.4 per cent of cases.

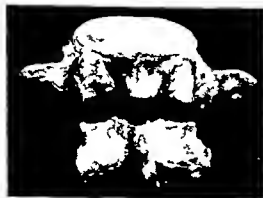
Junghans, in a recent paper, considers the role of lesion of the interarticular area of the lamina in their relation to spondylolisthesis.

Based on 30 cases examined at autopsy, spondylolisthesis was found to exist at the



F 3 Gos p m n B l t e l l of th thm f th f th a d fifth
l ml t b e A w d cate typ al t of d f t

which awaits only strain or blow to give way. In such cases abnormal strain is thrown on ligaments and pain ensues. Disability is out of all proportion to the severity of the accident just as it is in cases of trauma with old arthritis and in both recovery is long delayed or never comes.



Fg 4. P t n r w f fifth l mb t b C m
pl t parat t thm

Von Lackum in an excellent treatise on the mechanics of the lumbosacral region concludes in part that—

1. The lumbosacral joint is an unstable mechanism because (a) it is the juncture of a mobile and an immobile part (b) the usual means of joint stabilization are at a disadvantage in consequence of a developmental structure designed for the all fours position (c) it is the site of rotating action which is often asymmetrical (d) it is the site of tremendous shearing strain. 2. The strain at the joint is always shearing regardless of position. 8. Fusion can be done without fear of affecting the usefulness of the part.

In 1927 Asbury reports his clinical observations of 27 definite cases of spondylolisthesis.

Subluxation of the fourth lumbar vertebra occurred three times in this series but in each instance was secondary to subluxation of the fifth lumbar vertebra. In my opinion this is always true because the variations defects and normal conditions necessary for the pro



Fig. 5 Posterior view of third fourth and fifth lumbar vertebrae



Fig. 6 Lateral view of third fourth and fifth lumbar vertebrae

duction of spondylolisthesis are present only at the lumbosacral joint. His cases ranged from 13 to 63 years of age with over one half in the third decade. In 23 of 7 cases trauma was a definite etiological factor in the production of this slipping. Backache was the chief complaint in 93 per cent.

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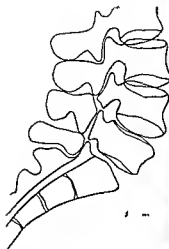


Fig. 1. Left lateral roentgenogram of the spine (Fig. 3).



Fig. 8. Anteroposterior lateral roentgenogram of specimen (Fig. 3).

fifth lumbar vertebra in 20 cases and at the fourth in 10 cases. A cleft formation in the interarticular portion was found in all instances. He suspects a congenital anomaly in the bone nucleus formation which leads to the development of an abnormal epiphysis at this point. Contrary to many statements in the literature there is normally no epiphyseal line between the superior and inferior articulations. But for this assumption of abnormal splitting of the bone nuclei of each half of the arch there was found no corresponding anatomic foundation in the examination of numerous spinal columns of the newborn.

Meyer makes a sharp distinction between the actual slipping process and the preliminary stage, the loosening of the interarticular portion. He considers the latter always an acquired condition resulting from (a) a peculiarity in the relative positions of the lateral articulation, (b) the increased strain due to lordosis, and (c) excessive motion at the lumbosacral juncture.

The general considerations of spondylolisthesis have been described so well in the papers Spondylolisthesis by Turner and Tchirkin Albee and Meyerding that further discussion would seem unwarranted.

Of all the factors involved in the production

of spondylolisthesis the solution of bony continuity of the interarticular area of the lamina is probably the most important.

T. A. Willis' paper on Vertebral Anomalies deals with the incidence of separate neural arch of the vertebra in so clear and comprehensive a manner that rather extensive quotation is permissible.

The condition described in our earlier papers as separate neural arch has long been recognized, but its frequency of occurrence has not been appreciated. Poirer referred to it and it has been mentioned in anatomical discussions as a rare variation. Le Double in 1911 recorded 2 instances in literature and added 11 of his own. In 1923 the writer reported 31 specimens found among 748 skeletons (4.28 per cent). In 1914 Turner described the condition reporting several cases.

Neugebauer ascribed the condition to lack of fusion between two centers of ossification existing in each lateral half of the neural arch. This explanation has apparently been followed except by Lane, who attributed the separation in his case to excavation of the bone by rotation of the last lumbar on the sacrum. Neugebauer's theory would be sufficient if his postulated double centers of ossification were actually found. I have not yet



Fig 9 left Tracing of lateral roentgenogram Case 1
Fig 10 Case 1 Loss of bony continuity at isthmus

of last lumbar vertebra First stage spondylolisthesis
Narrowing of intervertebral disc

discovered embryological confirmation thereof in study of specimens or in literature

The separation of the neural arch occurs in the lamina between the superior and inferior articular processes so that the body of the affected vertebra with its superincumbent weight loses bone connection with the spinous and inferior articular processes that anchor the trunk to the pelvis. This is a most important factor in spondylolisthesis and should be more generally recognized. The defect may be unilateral as in 15 of our 57 specimens, 13 on the right and 2 on the left or bilateral as in 42. It was found in female skeletons 3 times and males 54. Once the first lumbar was affected once the third 5 times the fourth 45 times the fifth lumbar and 5 times the sixth.

It has been suggested that the separate neural arch is really a fracture. If so the last lumbar vertebra is the most frequently fractured of all bones as 38 per cent of the skeletons examined showed such separation. Consideration of the individual specimens shows no callus formation or rounding off the fragments suggesting fracture without union. In bilateral defects of the arch separation of the fragments might account for lack of attempted union but in the unilateral defect immobiliza-

tion of the parts by the intact lamina is perfect and these also show no callus or attempt at union. In the writer's opinion actual disunion when it occurs is the result of trauma but there is a pre-existing defect in the neural arch so that fibrous or cartilaginous tissue is ruptured rather than bone and this shows no bone callus forming function. Such tissue separates more readily than bone and stretches under strain so that displacement of the fragments becomes more and more marked anchorage of the spinal column to the sacrum depending entirely upon the stretching fibrous structure. Some of the specimens examined showed beveling of the lumbosacral surfaces suggesting frequent sliding of the one on the other.

ISTHMUS

In the following observations relative to lesions of the interarticular portions of the laminae and their relation to spondylolisthesis the term isthmus is employed to designate this portion of the neural arch. 'Isthmus' is descriptive and conveys the impression of a narrowing as well as the linking of two larger parts. On observing the pars interarticularis of normal lumbar vertebrae it will be noted that this area is the most narrow portion of the entire neural arch measuring in its cross



Fig. 1. Case 2. Age 13 years. Lesion of the lumbar region.

section from but one half to two thirds of the corresponding sections of the pedicle or the posterior portion of the lamina.

The great discrepancy between the high incidence of lesions of the isthmus reported from observations of anatomical material by Willis and others and the scarcity of such lesions reported during life indicate that observations of the lumbosacral region are frequently incomplete or that the presence of

such lesions is unknown or not generally recognized. Any lesion found in 4 per cent of individuals must be considered as of common occurrence and any accurate evaluation of such lesions from a clinical standpoint must necessarily depend on an accurate knowledge of its presence or absence in the lumbar spines of long series of patients with and without low back symptoms.

Röntgenologists are frequently at fault for not insisting on good films which will reveal the detail of all bony structures at the lumbosacral juncture. Good lateral films may be obtained with great regularity if sufficient skill is displayed by technicians. If only a portion of the interest now shown in demonstrating gastric lesions could be employed in the study of lumbosacral lesions the results would be enlightening. Further consideration of the roentgenology of this area will be found elsewhere in this paper.

Von Lackum has called attention to the constant presence of shearing strains at the lumbosacral juncture and it is hardly necessary to mention the principle of the inclined plane as applied to this region (Figs. 1 and 2). Reference to the diagrams and table of shearing forces will emphasize the tremendous forces acting on the isthmus of the lamina.

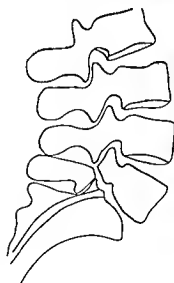


Fig. 1. Case 1. Lesion of the lumbar region. Fig. 2. Case 2. Lesion of the lumbar region. Fig. 3. Case 3. Lesion of the lumbar region. Fig. 4. Case 4. Lesion of the lumbar region. Fig. 5. Case 5. Lesion of the lumbar region. Fig. 6. Case 6. Lesion of the lumbar region. Fig. 7. Case 7. Lesion of the lumbar region. Fig. 8. Case 8. Lesion of the lumbar region. Fig. 9. Case 9. Lesion of the lumbar region. Fig. 10. Case 10. Lesion of the lumbar region. Fig. 11. Case 11. Lesion of the lumbar region. Fig. 12. Case 12. Lesion of the lumbar region. Fig. 13. Case 13. Lesion of the lumbar region. Fig. 14. Case 14. Lesion of the lumbar region. Fig. 15. Case 15. Lesion of the lumbar region. Fig. 16. Case 16. Lesion of the lumbar region. Fig. 17. Case 17. Lesion of the lumbar region. Fig. 18. Case 18. Lesion of the lumbar region. Fig. 19. Case 19. Lesion of the lumbar region. Fig. 20. Case 20. Lesion of the lumbar region. Fig. 21. Case 21. Lesion of the lumbar region. Fig. 22. Case 22. Lesion of the lumbar region. Fig. 23. Case 23. Lesion of the lumbar region. Fig. 24. Case 24. Lesion of the lumbar region. Fig. 25. Case 25. Lesion of the lumbar region. Fig. 26. Case 26. Lesion of the lumbar region. Fig. 27. Case 27. Lesion of the lumbar region. Fig. 28. Case 28. Lesion of the lumbar region. Fig. 29. Case 29. Lesion of the lumbar region. Fig. 30. Case 30. Lesion of the lumbar region. Fig. 31. Case 31. Lesion of the lumbar region. Fig. 32. Case 32. Lesion of the lumbar region. Fig. 33. Case 33. Lesion of the lumbar region. Fig. 34. Case 34. Lesion of the lumbar region. Fig. 35. Case 35. Lesion of the lumbar region. Fig. 36. Case 36. Lesion of the lumbar region. Fig. 37. Case 37. Lesion of the lumbar region. Fig. 38. Case 38. Lesion of the lumbar region. Fig. 39. Case 39. Lesion of the lumbar region. Fig. 40. Case 40. Lesion of the lumbar region. Fig. 41. Case 41. Lesion of the lumbar region. Fig. 42. Case 42. Lesion of the lumbar region. Fig. 43. Case 43. Lesion of the lumbar region. Fig. 44. Case 44. Lesion of the lumbar region. Fig. 45. Case 45. Lesion of the lumbar region. Fig. 46. Case 46. Lesion of the lumbar region. Fig. 47. Case 47. Lesion of the lumbar region. Fig. 48. Case 48. Lesion of the lumbar region. Fig. 49. Case 49. Lesion of the lumbar region. Fig. 50. Case 50. Lesion of the lumbar region. Fig. 51. Case 51. Lesion of the lumbar region. Fig. 52. Case 52. Lesion of the lumbar region. Fig. 53. Case 53. Lesion of the lumbar region. Fig. 54. Case 54. Lesion of the lumbar region. Fig. 55. Case 55. Lesion of the lumbar region. Fig. 56. Case 56. Lesion of the lumbar region. Fig. 57. Case 57. Lesion of the lumbar region. Fig. 58. Case 58. Lesion of the lumbar region. Fig. 59. Case 59. Lesion of the lumbar region. Fig. 60. Case 60. Lesion of the lumbar region. Fig. 61. Case 61. Lesion of the lumbar region. Fig. 62. Case 62. Lesion of the lumbar region. Fig. 63. Case 63. Lesion of the lumbar region. Fig. 64. Case 64. Lesion of the lumbar region. Fig. 65. Case 65. Lesion of the lumbar region. Fig. 66. Case 66. Lesion of the lumbar region. Fig. 67. Case 67. Lesion of the lumbar region. Fig. 68. Case 68. Lesion of the lumbar region. Fig. 69. Case 69. Lesion of the lumbar region. Fig. 70. Case 70. Lesion of the lumbar region. Fig. 71. Case 71. Lesion of the lumbar region. Fig. 72. Case 72. Lesion of the lumbar region. Fig. 73. Case 73. Lesion of the lumbar region. Fig. 74. Case 74. Lesion of the lumbar region. Fig. 75. Case 75. Lesion of the lumbar region. Fig. 76. Case 76. Lesion of the lumbar region. Fig. 77. Case 77. Lesion of the lumbar region. Fig. 78. Case 78. Lesion of the lumbar region. Fig. 79. Case 79. Lesion of the lumbar region. Fig. 80. Case 80. Lesion of the lumbar region. Fig. 81. Case 81. Lesion of the lumbar region. Fig. 82. Case 82. Lesion of the lumbar region. Fig. 83. Case 83. Lesion of the lumbar region. Fig. 84. Case 84. Lesion of the lumbar region. Fig. 85. Case 85. Lesion of the lumbar region. Fig. 86. Case 86. Lesion of the lumbar region. Fig. 87. Case 87. Lesion of the lumbar region. Fig. 88. Case 88. Lesion of the lumbar region. Fig. 89. Case 89. Lesion of the lumbar region. Fig. 90. Case 90. Lesion of the lumbar region. Fig. 91. Case 91. Lesion of the lumbar region. Fig. 92. Case 92. Lesion of the lumbar region. Fig. 93. Case 93. Lesion of the lumbar region. Fig. 94. Case 94. Lesion of the lumbar region. Fig. 95. Case 95. Lesion of the lumbar region. Fig. 96. Case 96. Lesion of the lumbar region. Fig. 97. Case 97. Lesion of the lumbar region. Fig. 98. Case 98. Lesion of the lumbar region. Fig. 99. Case 99. Lesion of the lumbar region. Fig. 100. Case 100. Lesion of the lumbar region.

when the upright position is assumed. The potential force of weight bearing becomes almost unbelievable when increased by the inertia of motion, leverage and muscle spasm resulting from sudden strains or falls.

The normal isthmus of intact bone being rigid and inelastic it must withstand this shearing force without much assistance from the soft structures which are in some measure relaxed and to some extent elastic (Fig. 1). Sudden severe shearing strain may readily cause solution of continuity through the isthmus before the full checking effect of the soft structures comes into play. Under these circumstances the posterior neural arch and the body of the last lumbar vertebra tend to separate because of the superincumbent weight. In the absence of bone repair the shearing strain must be resisted by the soft tissues alone. This type of tissue does not withstand prolonged strain as does bone, undergoes gradual elongation and may be the site of pathological changes. A similar mechanism is present in unreduced congenital dislocation of the hip.

Should a congenital cleft be present in the region of the isthmus, the above factors would be much more effectual in altering the relations at the lumbosacral juncture.

The exact coincidence of the point of maximum shearing strain of the isthmus and the site of 'congenital clefts' suggests the possibility that some of these clefts may in reality be fractures occurring during early childhood.

Very little investigation has been carried out to ascertain the presence of true congenital clefts. Willis writes as previously mentioned:

I have not yet discovered embryological confirmation thereof in study of specimens or in literature. In a more recent personal communication Willis states that he has found such a lesion in the study of fetal spines. Junghanns says: 'But for this assumption of abnormal splitting of the bone nuclei of each half of the arch there was found no corresponding anatomic foundation in the examination of numerous spinal columns of the newborn.'

In an attempt to establish developmental defects of the ossification of the isthmus of the lamina as having direct connection with the clefts found clinically or at postmortem, a study was made of fetal spines. Serial histological sections of the lumbar spines of fetuses were made in such a manner as to reveal the region of the isthmus. No instance of a divided osteogenetic center of the laminae was

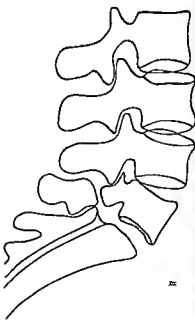


Fig. 4. Tracing made of the roentgenogram in Case 3.

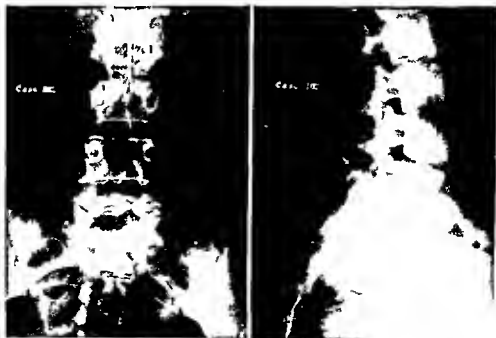


Fig. 15. Roentgenograms of Case 3 of isthmus. (See operative findings.) Traumatic lesions



Fig. 1. Case 3. Lateral view of lumbar spine.

section from but one half to two thirds of the corresponding sections of the pedicle or the posterior portion of the lamina.

The great discrepancy between the high incidence of lesions of the isthmus reported from observations of anatomical material by Willis and others and the scarcity of such lesions reported during life indicate that observations of the lumbosacral region are frequently incomplete or that the presence of

such lesions is unknown or not generally recognized. Any lesion found in 4 per cent of individuals must be considered as of common occurrence and any accurate evaluation of such lesions from a clinical standpoint must necessarily depend on an accurate knowledge of its presence or absence in the lumbar spines of long series of patients with and without low back symptoms.

Roentgenologists are frequently at fault for not insisting on good films which will reveal the detail of all bony structures at the lumbosacral juncture. Good lateral films may be obtained with great regularity if sufficient skill is displayed by technicians. If only a portion of the interest now shown in demonstrating gastric lesions could be employed in the study of lumbosacral lesions the results would be enlightening. Further consideration of the roentgenology of this area will be found elsewhere in this paper.

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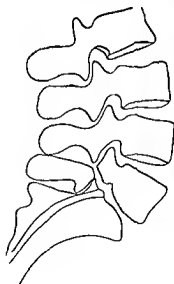


Fig. 2. Diagram of lumbar spine. Fig. 3. Lateral view of lumbar spine. Fig. 4. Lateral view of lumbar spine.

flares widely along its anterior and lateral margins. Large smooth osteophytes overhang the periphery of the articular borders. The superior lateral articulations show large osteophytes which extend medially well overlapping the inferior process of the third lumbar vertebra. The spinous process shows evidence of abundant new bone formation throughout its superior surface apparently produced by the same stimulus which resulted in the similar change (described above) on the spinous process of the third lumbar vertebra.

This spinous process together with the laminae and inferior articulations forms a single loose fragment which is separated from the superior articulation by narrow, nearly transverse clefts about 0.5 centimeter below the lower margins of the facets of the superior articular processes. The margins of the cleft at the isthmus on either side are thin, only slightly irregular and show no evidence of new bone formation. The body of the fifth lumbar vertebra is somewhat flattened. Definite new bone surrounds the superior articular surface at the site of attachment of the capsular ligament. The posterior portion of the neural arch is free, being separated by transverse clefts of the isthmus at the lower margins of



Fig. 18. Case 5. Aged 56 years. Spondylolisthesis of fourth lumbar vertebra. Tumor could be noted only on deep palpation.

the articular facets of the superior lateral articular processes.

This entire specimen was rearticulated by means of elastic bands to hold the vertebrae and their fragments in position. On hyperextension the tip of the lower lateral articular

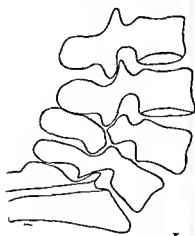


Fig. 19. Left. X-ray tracing. Case 5.
Fig. 20. Roentgenograms. Case 5. Note posterior displacement of spinous process and anterior displacement of

body of the fourth lumbar vertebra. In the anteroposterior view note pseudarthrosis between laminae of the third and fourth lumbar vertebrae. (See operative findings.)

found Osteogenesis was found to begin in the interarticular portion and to extend gradually in both directions that is anteriorly through the pedicle proper to meet the body and posteriorly to meet the lamina of the opposite side (Figs 52 53 54 55) In several sections it was noticed that ossification progressed by forming cyst like spaces the thin shell of bone replacing the cartilage in the region of the isthmus Such an area of incomplete ossification entirely replacing the cartilage at the isthmus would leave a vulnerable area which because of being more rigid than the adjacent cartilage might give way under certain conditions of stress The ossification of the isthmus of the fifth lumbar vertebra was not found to vary from that of the proximal vertebra and therefore does not explain the prevalence of this lesion in the lower lumbar vertebrae

The incomplete fissure occasionally seen at the region of the isthmus in the roentgenogram adds weight to the theory of defective ossification rather than fracture Complete division through the isthmus with separation of the fragments must be attributed to trauma either acute or chronic

A specimen revealing bilateral lesions of the isthmus of the fourth and fifth lumbar verte-

brae is shown in Figures 3 to 8 This specimen consists of a loosely articulated vertebral column including the lumbar vertebrae and sacrum All soft structures have been removed and a description is necessarily limited to the bony elements

The general contour and structure of the first and second lumbar vertebrae are well within normal limits except for moderate wedging of the body of the former and definite osteophytic lipping of the margins of the articulating body surfaces on the anterior and lateral aspects Osteophytic changes of much lesser degree are present about the margins of the lateral articular processes

The body of the third lumbar vertebra is well formed and gives only slight evidence of osteophytic changes about its margins The inferior portion of its spinous process is fanned out to about three times its normal width This change is very evidently that of new bone formation stimulated in part at least by contact with the superior surface of the spinous process of the fourth lumbar vertebra Osteophytes are more pronounced on the margins of both the superior and inferior articular processes

The upper portion of the body of the fourth lumbar is quite normal while the inferior part



Fig 6 Left T 4 gram of the isthmus of the fourth lumbar vertebra

F 7 Right T 4 gram of the isthmus of the fourth lumbar vertebra (S p rat)

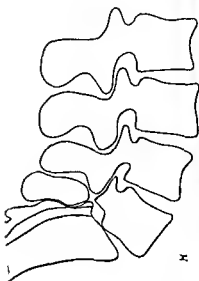


Fig. 30 left Tracing made of the roentgenogram in Case 10



Fig. 31 Roent eno rams Case 10 Lesion of isthmus of last lumbar vertebra



the onset of low back pain was abrupt but could in no way be associated with any trauma

In 6 the onset of symptoms was gradual but was associated with repeated strains as lifting with the back partially flexed. In all cases symptoms were increased by prolonged standing carrying heavy objects or increased mobility at the lumbosacral juncture. Prolonged fixed strains were more incapacitating than frequent changes in position.

The lumbar pain was described as a dull ache across the posterior aspect of the sacrum extending laterally to the region of the sacroiliac joints. In 8 cases definite sciatic radiation was present. In 5 of these sciatica was bilateral, 1 showing bilateral foot drop. In 5 discomfort in the anterior aspects of the thighs accompanied the lumbar pain. In 5 no true radiation was present.

On examination of this series no uniform findings were made. Increase of the lumbar lordosis was a most common observation but in 1 case a total obliteration of the normal anterior curve of the lumbar spine was present. When spondylolisthesis was marked a characteristic bony tumor (Fig. 43) was found in the midline of the back. Proximal

to this a very abrupt lordosis was present. In each case of spondylolisthesis operated upon this tumor was found to consist of the spinous process and laminae left in their normal site while the spine had advanced anteriorly in relation to the sacrum by separation through the isthmus.

Muscle spasm was consistently present in all but 1 case. Tenderness in the lumbosacral region was a common observation. In cases of spondylolisthesis a typical shortening of the back and increased prominence of the buttocks and iliac crests were noted. Fixed sensory changes were found in only 1 case.

The X-ray findings were most consistent: separation of the neural arch through the region of the isthmus being bilateral in each case. In 15 cases this was found in the last presacral vertebra (fifth lumbar) alone; in cases lesions of both the fourth and fifth were present. In 1 the fourth lumbar alone was involved with no change in the fifth.

The angle of inclination of the superior surface of the first sacral vertebral body varied considerably, measuring from 25 to 80 degrees, averaging about 60 degrees. Inasmuch as measurements of this angle were made on films taken with the patient lying on his side, this

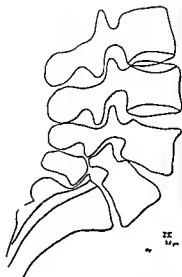


Fig. 8. Lateral X-ray showing lesion at fifth lumbar vertebra.



Fig. 29. Posteroanterior (Poen) X-ray showing lesion at fifth lumbar vertebra.



Fig. 30. Lateral X-ray showing lesion at fifth lumbar vertebra (S. O. P. rat. find gs).

In the clinical study of this lesion stereoscopic films of the lumbosacral juncture were made with the patient supine. An oblique anteroposterior shift was then made the central rays passing just above the symphysis pubis giving a flat projection of the lamina of the last lumbar vertebra. A lateral film (14 by 17) showing the entire sacrum and lumbar spine was then made. To secure more detail of the isthmus a true transverse film was made with a small cone.

The oblique projection missing the ilium on one side was found to be very unsatisfactory.

Considerable skill and patience is necessary to obtain satisfactory lateral films showing the bony detail of this region. In many cases the contour of the spinous process is lost by the heavy exposures. These films may be improved by partial reduction of the black areas.

Probably no one factor in the recognition of lesions of the isthmus is more important than suitable roentgenograms of this area.

SUMMARY OF CLINICAL CASES

Eighteen cases presenting lesions of the isthmus (interarticular) area of lamina have been studied in this series. All patients had been referred for orthopedic examination because of low back symptoms. Inasmuch as all

observations of patients presenting lesions of the isthmus have been in patients with low back symptoms no attempt to draw general conclusions has been made.

In this series of 18 cases the sex distribution was equal there being 9 males and 9 females. The age at the time of examination ranged from 13 to 56 years the average age being 34½ years. The ages at time of first symptoms were from 11 to 45 years the average being 28 years. The duration of symptoms prior to examination was from 1 week to 38 years with an average of about 7 years.

In 12 cases the onset of symptoms was very abrupt and in all but one of these associated with definite trauma. The types of acute trauma varied considerably in character but in each instance an abrupt increase in the shearing strains could well be expected. Falls resulting with the patient striking on the buttocks occurred in 4 cases. Direct blows to the lumbar area occurred in 2 cases. In both of these acute flexion of the spine accompanied the direct force. One case was rolled under a locomotive. In another symptoms date from a definite manipulation of contracted spinal muscles in the presence of a marked lordosis. Abrupt onset while lifting heavy objects occurred in 2 cases. In 1 case

articulations showed some variation as to planes but in general these were symmetrical and well formed. It was very interesting to note that the common gross developmental defects such as unilateral sacralization were entirely absent in this series. Sclerosis of the lumbar and sacro iliac regions was present to some degree in all cases. Changes characterizing old arthritic processes were not much in evidence even in the older cases.

Of this series of 18 just 50 per cent were operated upon. In each of the 9 cases the findings at operation were nearly identical. The spinous process lamina and inferior articulations in each case constituted a very mobile fragment attached only by relaxed ligamentous structures. The cleft of the lamina at the isthmus was found to be filled with firm fibrous tissue. No cartilage could be identified in any case at the site of this fission. In cases soft callus was found at the margins of the cleft. In the 5 cases of spondylolisthesis operated upon the loose fragment was very prominent forming the tumor seen on examination.

The posterior aspects of the lamina were exposed and freed of ligamentous tissue by subperiosteal dissection (Hibbs operation). Bone bridges were turned from one lamina to the adjacent one. As a heavy column of bone seemed desirable the Hibbs operation was reinforced by osteoperiosteal graft from the tibia or by large cancellous transplants from the posterior ilium. The ilium was exposed by a separate incision or by the transverse incision used in the trisacral fusion operation (Chandler). In each case the fusion extended from the third lumbar vertebra to the second or third sacral inclusive. The results of operation have been extremely satisfactory and point toward complete relief although the time postoperative is still rather short. One patient (Case 13) a very poor risk died from bladder complications but this must be considered as an operative death. Excepting this the post operative course was very mild in each case. The average period of recumbency was 7 weeks. Following this the back was protected with a reinforced fabric corset for 4 to 5 months.

The great mobility of the posterior segment of the neural arch found at each operation

clearly indicated that whatever stability remained at the lumbosacral juncture was due to soft tissue structures and not to bone.

CONCLUSIONS

- 1 Solution of bony continuity at the isthmus is a common lesion of the lower lumbar spine.

- 2 The presence of such a defect can be determined clinically and by the proper interpretation of good roentgenograms of the lumbar spine.

- 3 The stability and strength of the lumbosacral articulation is impaired by the presence of such defects.

- 4 The developmental origin of such clefts has been assumed rather than proved.

- 5 Further study of spines of the fetus and newborn is desirable.

- 6 Fractures of the isthmus are frequently complicated by spondylolisthesis.

- 7 Operation in selected cases will restore stability to the lumbosacral juncture.

I wish to express my appreciation to Doctors E. W. Ryerson and R. O. Ratter for their co-operation in the clinical phases of the study and to Doctors James T. Cline and L. L. Jenkinson, roentgenologists of Lassa and St. Luke's Hospitals respectively, and Miss Falk, X-ray technician, for their invaluable help in this study.

CLINICAL CASE REPORTS

CASE 1. F. B. female aged 40 years entered the hospital December 6, 1928 complaining of a dull aching pain in the lumbosacral region occasional pain radiating down the posterior aspect of the thighs to knees. This pain had been present for 8 years. At about 5 years of age during convalescence from scarlet fever patient suddenly lost all muscle function distal to lower dorsal region. The return of muscle function came about gradually during the next 2 years. Considerable doubt as to the exact cause of this paralysis existed it being considered as an anterior poliomyelitis by some eminent consultants and as a cord lesion of other origin by others.

During childhood and early adult life patient developed a marked lordosis and had some evidence of spasticity of both lower extremities. In 1921 during a course of manipulations directed toward the reduction of the lordosis under the supervision of an outstanding orthopedic surgeon she felt and heard something snap in her lower lumbar region and experienced sudden severe pain which radiated down the posterior aspects of both legs. Since that time she has had frequent attacks of similar pain which is greatly aggravated by standing riding in a motor car or on excessive motion of her lumbar

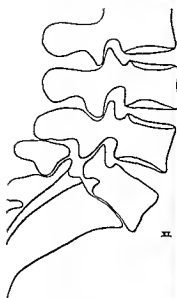


Fig. 32. Left tracing of the spine showing a spondylolisthesis at the fifth lumbar vertebra. Fig. 33. Right tracing of the spine showing a spondylolisthesis at the fifth lumbar vertebra. Fig. 34. Left tracing of the spine showing a spondylolisthesis at the fifth lumbar vertebra.

figure is probably much less than the true inclination of the sacral surface in the upright weight bearing position.

No forward slipping (spondylolisthesis) was found in 7 cases up to one half inch in 7 and from one half to 1 inch or more in 4. As mentioned this occurred at the lumbosacral

juncture with the exception of one case in which it occurred between the fourth and fifth lumbar vertebrae.

Spina bifida occulta of the fifth lumbar vertebra was present in but 1 case. Midline defects of the laminae of the upper sacral vertebrae were present in 6 cases. The lateral

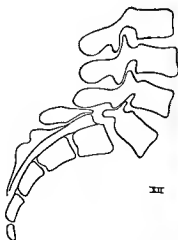


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spine At no time has there been any sensory or sph acter disturbance

Note Onset of lumbar pain was during passive flexion of lumbar spine

Examination revealed a short slightly overweight woman of about 40 years She stood with abdomen very prominent and upper trunk extended The contour of the back suggested some collapse of the spine it being short and broad and the iliac crests prominent A very pronounced loss of the lumbar spine is present At the level of the fourth spinous process there was a marked depress on in the midline Flexion throughout the lumbar area a very restricted but was compensated for by increased mobility of the hip joints Extension of the spine was painful Function of hips knees and ankles was normal The abdomen which was relaxed and prominent showed definite muscular weakness in all quadrants

Both patellar reflexes were hyperactive Babinski reflexes were present Ankle clonus was present on the left Both upper and lower abdominal reflexes were absent Irregular involuntary muscular contractions involve the left leg Sensation was normal Gait was somewhat suggestive of bilateral congenital dislocation of hips

Impression (1) Primary dorsal lateral sclerosis involving pyramidal tracts and anterior horn cells (2) Latent lordosis (3) Spondylohisthesia at lumbosacral juncture Patient was seen by Dr R A Hobbs in consultation and the findings were concurred in Spine fusion operation was advised but refused by patient Subsequent history is that of persistent discomfort of lumbar region with bilateral sciatic radiation Some extension deformities of toes of left foot are developing

Röntgenograms were made on December 18 1928 The anteroposterior view showed normal bony contours of lumbar spine and sacrum excepting that of the fifth lumbar which was low on the sacrum The laminae were narrow the spinous process as well formed The lateral articulations were not evident There was marked sclerosis of entire lumbosacral region The sacroiliac joints appeared normal

The lateral view showed a moderately marked lordosis involving the entire lumbar spine The intervertebral disc at the lumbosacral juncture was definitely thinned The body of the fifth lumbar was displaced anteriorly and down about $\frac{3}{4}$ inch The first sacral surface was rounded and deficient along its anterior margin The anteroposterior diameter of the fifth was $3\frac{3}{8}$ inches as compared to $3\frac{3}{4}$ inches of the fourth A very definite loss of bony continuity of the lamina was present in the interarticular region (isthmus) of the lamina of the fifth This was about $\frac{1}{4}$ inch wide The angle of the first sacral was 60 degrees

This patient had been unusually active physically and in spite of a marked lordosis had no low back symptoms until forced flexion

resulted in some change at the lumbosacral juncture which was manifest to the patient as a very distinct crack accompanied by severe referred pain Symptoms of varying degrees of intensity have persisted to the present time It is reasonable to believe that the demonstrable lesion of the isthmus occurred at that time The cross strains resulting from the lordosis and inclined sacral surface are greatly augmented by the leverage of passive flexion The firm interspinous and inferior capsular ligaments and other soft structures fixing the posterior portion of the neural arch to the sacrum and fourth lumbar vertebra permit the partial anterior displacement of the body of the fifth lumbar on the first sacral This displacement is maintained by the superimposed weight Further displacement is prevented by the ligaments and muscular structure as well as the resistance offered by the intervertebral disc The existence of a developmental cleft would seem unlikely in this instance because of the normal relations (as far as symptoms indicate) at the lumbosacral juncture in the presence of a severe lordosis The normal development of the posterior neural arch the spinous process and inferior articulation indicates that the structures have developed in response to the normal strains and functions present in intact vertebrae

The inciting factor in this case was trauma The presence of a pre-existing developmental fissure cannot be ruled out for obvious reasons but the exact coincidence of this possible defect with the point of maximum fracture strain would make it rather untenable

CASE 2 S. K. male aged 31 years, ink grinder was admitted to the hospital January 3 1931 Patient had been suffering with low back pain for 10 months Until onset of present condition this patient has been in good general health and has never had any low back disability While working as an ink grinder patient was caught by a power pulley and thrown across a room striking his upper lumbar area against a barrel He states that the distance he was thrown was about 12 feet He experienced severe pain in his lower back and though able to get up was unable to continue with his work He was treated by rest hot applications and a pelvic belt without relief Examinations by many consultants failed to reveal any pathology and compensation was stopped the patient being considered

a malingerer. This patient has repeatedly tried to carry on with his work but has been unable to do so because of low back pain which becomes intense after standing on his feet for any length of time or after walking more than 4 or 5 blocks. His history is otherwise essentially negative.

General examination was negative. The lumbar spine showed no abnormality of outline or flexibility but was very tender to pressure over the spines of the fifth lumbar and first sacral vertebrae. Reflexes were normal throughout. Sensation was normal. Temperature was 98.4 degrees, pulse 74, respiration 18. Urine was negative. Red blood cells numbered 4,530,000, white blood cells 8,650, hemoglobin 88 per cent.

Roentgenograms were taken on February 4, 1930. The anteroposterior view showed no abnormality other than a transverse type of lateral articulation at the lumbosacral juncture. The lateral view showed a low lumbar lordosis quite marked. The superior sacral surface approached the vertical. A very definite line indicated lack of bony continuity in the interarticular region of the laminae (isthmus) of the fifth lumbar vertebra. There was no anterior displacement of the body of the fifth on that of the first sacral vertebra. This patient was discharged from the ward February 11, 1930, without any treatment having been carried out. He was observed in the dispensary repeatedly and on April 7, 1930, was readmitted for operation.

Operation was performed April 9, 1930—a Hibbs fusion with an osteoperiosteal graft from the tuba fourth lumbar to fourth sacral inclusive. After subperiosteal dissection was complete the spinous process and laminae of the fifth lumbar vertebra were found to be freely movable in all directions showing definite lack of bony continuity through the isthmus on either side. This fragment was removed from the wound but was replaced before the wound was closed. The margins of the free ends of the laminae were covered with soft new bone suggesting in gross appearance callus formation. There was no evidence of any other attempt at bone repair connecting the loose posterior arch with the superior articular facets. Note. This case shows evidence of bone repair by callus formation at margins of the lesion of the isthmus. The postoperative course was very mild and the patient was discharged May 25, 1930, wearing a reinforced corset. This patient has been seen frequently in the follow up clinic. Relief of symptoms is good but as yet not complete.

In this case trauma was the inciting cause of the lesion of the isthmus of the last lumbar vertebra if full credence is placed in the history of onset. The exact mechanism of the lesion of the isthmus is probably very complicated although a blow striking the lumbar spine from behind and moving the pelvis and sacrum would exert its entire force on the

isthmus and produce more or less anterior displacement of the spine on the sacrum. The freedom of motion and absence of deformity point toward quite normal structural relations and absence of local irritation. The discomfort coming on after prolonged walking or standing is quite typically that associated with soft tissue strain. The osteophytic reaction revealed at operation would indicate fracture rather than separation through a developmental cleft.

CASE 3. A W. female aged 9 years domestic had pain in the lower lumbar region with occasional pain radiating down the posterior aspects of both legs. One week ago patient fell down a flight of stairs injuring her back. She does not remember any other details of her injury. Acute pain was present in the lumbar region but was not of such degree as to prevent her getting about.

Examination revealed no gross deformity of the lumbar region. Muscle spasm was marked and motion in all directions was very restricted. Pressure over the general area of the lumbosacral region revealed acute tenderness. The roentgenograms showed a sharp line suggesting a fracture in the region of the isthmus of the last lumbar vertebra. This patient was instructed to rest at home and to use a firm corset holding the lumbar spine and pelvis. During the following 4 months this patient was seen in the dispensary several times. The complaints remained about the same. She was admitted to the hospital May 6, 1930, 4 months after injury. Patient stated that pain was of a dull aching character and was located in the lumbar region and radiated toward the coccyx. It was exaggerated on walking or sitting and occasionally radiated down the back of each leg. Her general history revealed no other significant facts. Examination at this time revealed marked muscle spasm in the lumbar region with restriction of motion in all directions. Local tenderness was present over the region of lumbosacral juncture and over both sacroiliac joints. Reflexes of both legs were normal. Diagnosis: fracture of isthmus of last lumbar vertebra. (See photograph.)

Roentgenograms were taken January 17, 1930. The anteroposterior view showed failure of union of the lamina in the midline throughout the sacrum. The spinous processes of the fourth and fifth lumbar vertebrae were not as well formed as those proximal. The pelvis and sacroiliac joints appeared normal. The lateral view showed the body of the fifth lumbar vertebra displaced slightly anterior on the first sacral. A very definite line showing loss of bony continuity was present in the interarticular area (isthmus) of the laminae of the fifth lumbar vertebra.

Operation was performed May 7, 1930, and consisted in a transverse incision and subperiosteal dissection of the spinous processes and laminae of fourth

spine. At no time has there been any sensory or sphincter disturbance.

Note.—Onset of lumbar pain was during passive flexion of lumbar spine.

Examination revealed a short slightly over eight woman of about 40 years. She stood with abdomen very prominent and upper trunk extended. The contour of the back suggested some collapse of the spine, it being short and broad and the iliac crests prominent. A very pronounced lordosis of the lumbar spine was present. At the level of the fourth spinous process there was a marked depression in the midline. Flexion throughout the lumbar area was very restricted but was compensated for by increased mobility of the hip joints. Extension of the spine was painful. Function of hips, knees and ankles was normal. The abdomen, which was related as prominent, showed definite muscular weakness in all quadrants.

Both patellar reflexes were hyperactive. Babinski reflexes were present. Ankle clonus was present on the left. Both upper and lower abdominal reflexes were absent. Irregular involuntary muscular contractions involve the left leg. Sensation was normal. Gait was somewhat suggestive of bilateral congenital dislocation of hips.

Impressions.—(1) Primary dorsal lateral sclerosis involving paravertebral tracts and anterior horn cell. (2) Paralytic lordosis. (3) Spondylolisthesis at lumbosacral juncture. Patient was seen by Dr. R. A. Hibbs in consultation and the findings were concurred in. Spine fusion operation was advised but refused by patient. Subsequent history is that of persistent discomfort of lumbar region with bilateral sciatic radiation. Some extension deformities of toes of left foot are developing.

Roentgenograms were made on December 18, 1938. The anteroposterior view showed normal bony contours of lumbar spine and sacrum excepting that of the fifth lumbar which was low on the sacrum. The laminae were narrow, the spinous process was well formed. The lateral articulations were not evident. There was marked sclerosis of entire lumbosacral region. The sacroiliac joints appeared normal.

The lateral view showed a moderately marked lordosis involving the entire lumbar spine. The intervertebral disc at the lumbosacral juncture was definitely thinned. The body of the fifth lumbar was displaced anteriorly and down about $\frac{3}{4}$ inch. The first sacral surface was rounded and deficient along its anterior margin. The anteroposterior diameter of the fifth was $3\frac{1}{4}$ inches as compared to $3\frac{1}{2}$ inches of the fourth. A very definite loss of bony continuity of the lamina was present in the interarticular region (isthmus) of the laminae of the fifth. This was about $\frac{1}{2}$ inch wide. The angle of the first sacral was 60 degrees.

This patient had been unusually active physically and in spite of a marked lordosis had no low back symptoms until forced flexion

resulted in some change at the lumbosacral juncture which was manifest to the patient as a very distinct crack accompanied by severe referred pain. Symptoms of varying degrees of intensity have persisted to the present time. It is reasonable to believe that the demonstrable lesion of the isthmus occurred at that time. The cross strains resulting from the lordosis and inclined sacral surface are greatly augmented by the leverage of passive flexion. The firm interspinous and inferior capsular ligaments and other soft structures fixing the posterior portion of the neural arch to the sacrum and fourth lumbar vertebra permit the partial anterior displacement of the body of the fifth lumbar on the first sacral. This displacement is maintained by the superimposed weight. Further displacement is prevented by the ligaments and muscular structure as well as the resistance offered by the intervertebral disc. The existence of a developmental cleft would seem unlikely in this instance because of the normal relations (as far as symptoms indicate) at the lumbosacral juncture in the presence of a severe lordosis. The normal development of the posterior neural arch, the spinous process and inferior articulation indicates that these structures have developed in response to the normal strains and functions present in intact vertebrae.

The inciting factor in this case was trauma. The presence of a pre-existing developmental fissure cannot be ruled out for obvious reasons but the exact coincidence of this possible defect with the point of maximum fracture strain would make it rather untenable.

CASE 2.—S. K., male, aged 31 years, ink grinder, was admitted to the hospital January 30, 1939. Patient had been suffering with low back pain for 10 months. Until onset of present condition this patient has been in good general health and has never had any low back disability. While working as an ink grinder, patient was caught by a power pulley and thrown across a room striking his upper lumbar area against a barrel. He states that the distance he was thrown was about 12 feet. He complained severe pain in his low back and thought able to get up but was unable to continue with his work. He was treated by rest, hot applications and a pelvic belt without relief. Examinations by many consultants failed to reveal any pathology and compensation was stopped, the patient becoming dissatisfied.

vertebræ were in close contact and adjacent soft tissue had the appearance of pale granulation tissue. A specimen was removed for examination. A Hibbs fusion was done the exposed bone being used as a source of grafts.

Any relation of trauma to the onset of low back pain was indefinite in this case. Although there was definite anterior displacement of the fourth lumbar vertebra the back did not present the usual picture of a spondylohis thesis. The lordosis was evenly distributed throughout the lumbar region the bony 'tumor' was not present in the midline.

The roentgenograms and operative findings showed the collapse of the spine at the level of the fourth lumbar the body of the fourth being displaced anteriorly and the free posterior arch being displaced posteriorly. The inferior articular processes of the third lumbar vertebra wedged between the fragments of the fourth at the site of the lesion of the isthmus increased the displacement of the elements of the involved vertebra. Collapse in a vertical plane had been sufficient to permit the formation of a pseudarthrosis between the laminae of the third and fourth lumbar vertebrae.

CASE 6 A B white female aged 42 years laundress was admitted to Northwestern Medical School Dispensary May 15 1909. She complained of backache and heavy feeling in pelvis. There was partial incontinence of urine. About ten years ago without definite history of trauma she began to have low back discomfort after periods of standing or of heavy work. This had been gradually increasing to the present time. Sciatica was not present. The low back pain had been such as to interfere greatly with her work as a laundress. The department of gynecology made a diagnosis of chronic cervicitis and vaginitis and instituted local treatment.

Examination showed a rather obese woman with a prominent abdomen and a marked general lordosis. Motion of the lumbar spine was generally restricted especially to the right. Reflexes were normal.

Roentgenograms were made May 22 1909. The anteroposterior view showed the bodies of the lower dorsal and lumbar vertebrae to be normal in outline. There was a slight inclination to the left beginning at the lumbosacral juncture. The fifth lumbar vertebra was low and partially overlapped the first sacral body. Both lateral articulations between the fifth lumbar and first sacral were very indistinct and irregular in outline and position. Marked sclerosis of the last lumbar and first sacral vertebrae was present. The sacro iliac joints were well defined. Very slight lipping was present at their lower margins. The lateral view showed the

intervertebral space between the fifth lumbar and first sacral bodies to be very thin. The fifth body was displaced anteriorly about one quarter of an inch on the first sacral. There was marked osteophytic reaction along the adjacent margins of the bodies of the fifth lumbar and first sacral vertebrae. The spinous process of the fifth lumbar was very prominent projecting one half inch behind the line of the spinous processes of the upper lumbar vertebrae. The anteroposterior diameter of the fifth lumbar measures $4\frac{1}{2}$ inches as compared to that of the fourth which measures $4\frac{1}{8}$ inches on the negative. A very definite line showed loss of bony continuity of the lamina in the interarticular region (isthmus) $\frac{3}{8}$ inches wide. The angle of first sacral surface was 50 degrees. The lumbar lordosis was diminished as compared with the average. This patient was fitted with a fabric corset which gives her much relief and enables her to continue her work as a laundress 2 or 3 days a week.

The natural compensatory changes were well illustrated in this case. The thin intervertebral disc and the building up of the anterior margin of the body of the first sacral surface both add much to the security of the fifth and may be interpreted as an attempt to eliminate motion by fusion at this point.

CASE 7 W D male aged 45 years switchman was admitted to the hospital May 3 1930. That morning on stepping from footboard of switch engine he was thrown between the rails the engine passing over him and striking him in several places. He was able to crawl from beneath the engine. Because of injuries patient was brought directly to the hospital.

Examination showed a perineal laceration. There was a fracture of the 8th 9th 10th and 11th ribs on the right 2 inches lateral to the costochondral junction. Many abrasions were noted on upper extremities. The entire back was tender especially in the lower lumbar region.

Roentgenograms were made June 3 1930. The anteroposterior view showed a slight left lateral scoliosis throughout the lumbar spine. The apex was between the second and third lumbar vertebrae. The body of the second was displaced $\frac{1}{2}$ inch to the right on the body of the third. The right half of the superior surface of the third was rounded off to conform with the concave inferior surface of the body of the second. Several small bony deposits were present in the soft tissues to the right of the spine. The arch of the fifth was narrow but was well united in the midline. The lateral view showed arthritic lipping of the bodies of the third and fourth lumbar vertebrae. A line showing lack of bony continuity was present at the interarticular area or isthmus of the fifth lumbar vertebra. The body of the fifth was in normal relation to the first sacral surface. The sacral surface was slightly concave in its posterior half.

and fifth lumbar and first and second sacral vertebrae. The spinous process and laminae of the fifth lumbar vertebra were very unstable and showed failure of bony continuity in the isthmus region on both sides. Some soft new bone was found along the upper surface of the spinous process. Bone bridges after the method of Hibbs were made and the entire field covered with cancellous bone from the crest of the ilium. Postoperative course was normal. December 18, 1930 patient made last visit to dispensary. She was completely relieved of lumbar pains. X-ray films showed much new bone extending from fourth spinous process to sacrum.

Trauma was directly related to the onset of symptoms. The lesion of the isthmus as shown by the roentgenogram differed from others in this series in being more irregular and more characteristic of fracture. These X-ray films, however, were made shortly after the accident while in the other cases (excepting Case 7) films were made after a considerable period of time.

CASE 4. M. F. female aged 28 years housewife. Patient had had pain in the lumbosacral region since auto accident 5 years ago. At first the pain was associated with the onset of menstrual flow but for the past year has been constant except when lying down. Discomfort now is directly related to increased sitting and is relieved in the horizontal position. This patient complained also of considerable bowel discomfort and of irregular menstruation.

Examination revealed the sacrum rather prominent posteriorly. Flexion was moderately limited. Lateral bending was good with possibly some restriction to the right. There was a marked depression on the midline at the lumbosacral juncture. Joint function of both legs was good. Reflexes were normal. The urine was normal. Red blood cells numbered 4,120,000, hemoglobin was 78 per cent, white blood cells 7,850. The Wassermann was negative, Kahn negative.

Roentgenograms were made December 22, 1928. The anteroposterior view disclosed a failure of ossification of the neural arch throughout the sacrum. Marked sclerosis of the lateral portion of both laminae of the fifth lumbar and of the lateral articulations at the lumbosacral juncture was present. The left sacroiliac joint was thin showing some hitching at the lower margin. The left pubis was slightly higher than the right. The lateral view revealed the sacrum to be of a horizontal type. The body of the fifth lumbar was in normal relation to the first sacral. A rather indefinite line suggests solution of continuity of bone through the isthmus or interarticular area of the laminae of the fifth lumbar.

Operation was performed December 28, 1928—a Hibbs fusion operation third lumbar to second sacral inclusive. A spina bida occulta of the

sacrum was exposed. The spinous process and laminae of the fifth lumbar vertebra moved freely in all directions showing absence of bony continuity in both interarticular regions.

Trauma was very definite in this case. The roentgenograms did not reveal the bone structure sufficiently well to permit an accurate diagnosis of lesion of the isthmus. The free arch found at operation was very typical in every respect.

CASE 5. M. S. female aged 56 years housewife. Patient had had pain in the lower spine for 4 years. During childhood had had no back complaint. At about 17 years of age when lifting children she began to have considerable discomfort in lower lumbar region. Since birth of child at 18 years she has had frequent backache. About 4 years ago she fell down a flight of steps to basement injuring her left wrist, knees and back. Her back condition did not incapacitate her at that time. In March 1930 she again injured her back by a fall on the ice. Since this fall her back complaint has become much more prominent. At the present she has constant backache and radiating pains to the thighs and knees. Patient indicates a transverse area over upper sacral region as the location of her pain.

Examination of the spine showed some vertebral collapse with marked lordosis and prominence of gluteal regions. The spinous processes of the fourth and fifth lumbar vertebrae were very prominent with a definite depression proximally. On motion there was pain in the lumbar region especially on extension and right lateral bending. The abdomen was very prominent and relaxed. Reflexes of the lower extremities were normal.

Roentgenograms were made July 3, 1930. The anteroposterior view revealed a well localized level of osteophytic reaction involving the adjacent margins of the fourth and fifth lumbar vertebrae. The intervertebral space was definitely narrowed. The laminae of the third and fourth lumbar vertebrae were in direct contact forming a pseudarthrosis which extended transversely with very marked sclerosis of the opposing surfaces. The lateral view revealed an anterior displacement of the fourth lumbar body on the fifth. The offset measured about $\frac{3}{4}$ inch. The spinous processes of the third fourth and fifth lumbar vertebrae were in close approximation with that of the fourth more prominent posteriorly. A line of fracture was present in the interarticular or isthmus region of the laminae of the fourth lumbar vertebra permitting a separation of about $\frac{1}{4}$ inch.

Operation was performed August 13, 1930. A midline incision exposing third lumbar to second sacral laminae inclusive was made. The posterior neural arch of the fourth lumbar vertebra was very mobile and fracture lines on both right and left sides were readily demonstrated in the region of the isthmus. The laminae of the third and fourth lumbar

vertebræ were in close contact and adjacent soft tissue had the appearance of pale granulation tissue. A specimen was removed for examination. A Hibbs fusion was done the exposed bone being used as a source of grafts.

Any relation of trauma to the onset of low back pain was indefinite in this case. Although there was definite anterior displacement of the fourth lumbar vertebra the back did not present the usual picture of a spondylosis thesis. The lordosis was evenly distributed throughout the lumbar region the bony 'tumor' was not present in the midline.

The roentgenograms and operative findings showed the collapse of the spine at the level of the fourth lumbar the body of the fourth being displaced anteriorly and the free posterior arch being displaced posteriorly. The inferior articular processes of the third lumbar vertebra wedged between the fragments of the fourth at the site of the lesion of the isthmus increased the displacement of the elements of the involved vertebra. Collapse in a vertical plane had been sufficient to permit the formation of a pseudarthrosis between the laminae of the third and fourth lumbar vertebrae.

CASE 6 A B white female aged 42 years laundress was admitted to Northwestern Medical School Dispensary May 15 1929. She complained of backache and heavy feeling in pelvis. There was partial incontinence of urine. About ten years ago without definite history of trauma she began to have low back discomfort after periods of standing or of heavy work. This had been gradually increasing to the present time. Sciatica was not present. The low back pain had been such as to interfere greatly with her work as a laundress. The department of gynecology made a diagnosis of chronic cervicitis and vaginitis and instituted local treatment.

Examination showed a rather obese woman with a prominent abdomen and a marked general lordosis. Motion of the lumbar spine was generally restricted especially to the right. Reflexes were normal.

Roentgenograms were made May 22 1929. The anteroposterior view showed the bodies of the lower dorsal and lumbar vertebrae to be normal in outline. There was a slight inclination to the left beginning at the lumbosacral juncture. The fifth lumbar vertebra was low and partially overlapped the first sacral body. Both lateral articulations between the fifth lumbar and first sacral were very distinct and irregular in outline and position. Marked sclerosis of the last lumbar and first sacral vertebrae was present. The sacroiliac joints were well defined. Very slight liping was present at their lower margins. The lateral view showed the

intervertebral space between the fifth lumbar and first sacral bodies to be very thin. The fifth body was displaced anteriorly about one quarter of an inch on the first sacral. There was marked osteophytic reaction along the adjacent margins of the bodies of the fifth lumbar and first sacral vertebrae. The spinous process of the fifth lumbar was very prominent projecting one half inch behind the line of the spinous processes of the upper lumbar vertebrae. The anteroposterior diameter of the fifth lumbar measures $4\frac{1}{2}$ inches as compared to that of the fourth which measures $4\frac{1}{8}$ inches on the negative. A very definite line showed loss of bony continuity of the lamina in the interarticular region (isthmus) $\frac{3}{16}$ inches wide. The angle of first sacral surface was 50 degrees. The lumbar lordosis was diminished as compared with the average. This patient was fitted with a fabric corset which gives her much relief and enables her to continue her work as a laundress 2 or 3 days a week.

The natural compensatory changes were well illustrated in this case. The thin intervertebral disc and the building up of the anterior margin of the body of the first sacral surface both add much to the security of the fifth and may be interpreted as an attempt to eliminate motion by fusion at this point.

CASE 7 W D male aged 45 years switchman was admitted to the hospital May 23 1910. That morning on stepping from footboard of switch engine he was thrown between the rails the engine passing over him and striking him in several places. He was able to crawl from beneath the engine. Because of injuries patient was brought directly to the hospital.

Examination showed a perineal laceration. There was a fracture of the 8th 9th 10th and 11th ribs on the right 2 inches lateral to the costochondral junction. Many abrasions were noted on upper extremities. The entire back was tender especially in the lower lumbar region.

Roentgenograms were made June 3 1930. The anteroposterior view showed a light left lateral scoliosis throughout the lumbar spine. The apex was between the second and third lumbar vertebrae. The body of the second was displaced $\frac{3}{8}$ inch to the right on the body of the third. The right half of the superior surface of the third was rounded off to conform with the concave inferior surface of the body of the second. Several small bony deposits were present in the soft tissues to the right of the spine. The arch of the fifth was narrow but was well united in the midline. The lateral view showed arthritic liping of the bodies of the third and fourth lumbar vertebrae. A line showing lack of bony continuity was present at the interarticular area or isthmus of the fifth lumbar vertebra. The body of the fifth was in normal relation to the first sacral surface. The sacral surface was slightly concave in its posterior half.

This patient left the hospital after a few days and cannot be located for more details of his condition.

CASE 8 L. R. white female aged 13 years American student. Patient had difficulty in walking and pain in the lumbar region and in both thighs. In December 1929 while carrying her arms full of groceries she slipped on the icy sidewalk. In falling she tried to prevent breaking her wrist watch and bottle of milk which she was holding. She struck the sidewalk in a semi-reclining and a twisting position. She was very much frightened but was able to get up and carry her bundles home. The acute discomfort in the lumbar region soon subsided and after several days disappeared. There was no particular discomfort until June 1930. While sitting in school she had a sudden onset of throbbing and shooting pain in the lumbar region. She cannot recall any unusual strain of lumbar region immediately preceding this attack. She continued with her school work for 2 days and then she remained at home because of pain in the lumbar region which was greatly aggravated by walking. The discomfort increased on activity and was relieved only by rest in bed and the use of a pelvic binder. There was no history of lumbar or sciatic pain previous to the injury. Her general health had been excellent. There had been no symptoms referable to cardiovascular, gastro-intestinal, genito-urinary or neuromuscular systems.

Lamination revealed temperature of 99 degrees, pulse 90, blood pressure 102-75. (See photograph.) General examination revealed no abnormality other than that of the lumbar spine. The lumbar spine was held partially flexed with lumbar lordosis obliterated thus causing undue prominence of the posterior processes of the entire lumbar area. There was marked spasm of the lumbar muscles. Lateral bending was fairly free but flexion and extension were definitely limited by muscle spasm and pain in the lumbar region and in both thighs. Standing as possible with support. The lower extremities showed normal range of motion in all joints except that by pressure on the thighs was restricted by lumbar pain. Reflexes were normal no sensory changes were present. The urine was straw-colored and specific gravity 1.07, albumin 5 milligrams per 10 cubic centimeters and a few leucocytes and epithelial cells. There were 3,660,000 red blood cells, 6,800 white blood cells and haemoglobin 64 per cent.

Röntgenograms were taken July 10, 1930. The anterior-posterior view showed the lumbar spine and sacro-lumbar regions normal except for a mild defect of the posterior arches of the entire sacrum. The laminae and spinous process of the fifth lumbar vertebra were definitely narrower and more sclerotic than those of the next level proximal. The lateral view showed the sacrum quite horizontal but the superior surface made about a 45 degree angle by a marked overdevelopment of the anterior margin. A definite lack of bony continuity was present in the interarticular or isthmus region. This line was

about one half inch in width. No anterior displacement of the fifth lumbar was present in this position.

Operation was performed August 16, 1930. A midline incision was used. A Hibbs dissection exposed the third lumbar to the second sacral spines and laminae. The spinous process of the fifth lumbar was rather prominent and moved without relation to the body of the fifth lumbar vertebra. A line of fracture or lack of bony continuity was present in the interarticular region on both sides. A mild defect was found at the first sacral level. After a careful dissection bone chips were turned down from the exposed laminae. This was reinforced by a graft from the crest of the left ilium.

Trauma was directly related to the onset of symptoms. The mechanism of the force acting on the isthmus was one of a shearing strain on a moderately inclined sacral surface increased by flexion of the lumbar spine. The inertia of the superimposed weight was augmented by contraction of the trunk muscles. A relatively free period intervened between the original disability following trauma in December 1929 and the acute symptom coming on without inciting trauma in June 1930.

A typically loose posterior neural arch was found at operation.

Very recent (January 1931) observation of this girl indicates complete relief of symptoms.

CASE 9 M. A. female aged 28 years housewife complained that pain in the posterior aspects of the right and left legs had been present for 3 years when without injury or warning patient began to have pain in the right lower quadrant of the abdomen and low in the posterior aspect of the right leg. An appendectomy was done at that time which resulted in relief of the abdominal pain. The right sciatic pain persisted during all forms of activity but was relieved when patient rested in the horizontal position. About 2 years ago a similar pain developed in the left lower abdomen and radiated down the left sciatic region. The discomfort in both legs was always increased by standing or prolonged walking. Other than for this discomfort the patient was in excellent health. General physical examination was essentially negative. The back was well formed and straight. Definite tenderness was present on pressure over the spines of the fourth and fifth lumbar vertebrae. Movement of the spine was distinctly limited in all directions throughout the lumbar area. Extension caused increased discomfort in the posterior aspects of both legs. Both lower extremities show no impaired joint function or abnormal reflexes. Straight leg bending was restricted on both sides. The urine was normal. The red blood cell numbered 3,040,000, hemoglobin was 76 per cent, white blood cells 6,400.

Roentgenograms were taken on October 22 1928. In the anteroposterior view six lumbar vertebrae were present. An angulation suggesting a slight displacement to the right was present at the lumbo-sacral juncture. The bone at this level was somewhat sclerotic. Both sacro iliac joints showed slight hiping at their lower margins. The lateral articulations were in a transverse vertical plane. The lateral view showed the sixth lumbar vertebra displaced about $\frac{1}{4}$ inch anteriorly on the first sacral and angulated and displaced slightly forward in relation to the body of the fifth. The relation of the spinous process seemed to be normal. A rather indefinite line indicated solution of bony continuity through the interarticular (isthmus) region of the laminae of the sixth lumbar vertebra. Slight narrowing of the intervertebral space was present.

Operation was performed October 30 1928. A Hibbs fusion operation was done the spine being fused from the third lumbar to the second sacral inclusive and reinforced with osteoperiosteal graft from the tibia. The spine and posterior arch of the fifth lumbar vertebra were found to be extremely mobile and not attached to the vertebral body by other than soft tissue in the region of the isthmus on either side. A low grade infection of the wound developed but cleared at an early date.

Recent reports from this patient indicate that stabilization by fusion has entirely relieved her of low back and sciatic pain. The result is excellent.

No definite association of trauma with the onset of symptoms could be established in this case. Bony fixation has given complete relief.

CASE 10. H. B. male aged 32 years white student. Patient had pain in the right lumbosacral region and in the right testicle. When 14 years of age he first noticed a burning sensation in the right lower lumbar region after shocking corn. There was no history of a distinct trauma at this time. This discomfort had continued until the present time and had varied considerably as to intensity. At present the pain radiates down the posterior aspect of the right leg. The testicular pain as attributed to a direct injury at the age of 17 years. Six months ago he was under observation in a Chicago hospital because of the low back pain and sciatica but no diagnosis was made. General history revealed no other essential facts relative to his back condition.

Examination showed the pelvis tilted slightly to the right. The lumbar spine as deviated to the right. Definite restriction of lumbosacral flexion was present. Some tenderness was noted in the midline at the lumbosacral juncture. Reflexes were normal. The blood Wassermann as negative the urine was negative. Roentgenograms were taken February 12 1927. The anteroposterior view showed marked sclerosis in both sacro iliac joints especially in the region of the articular surface of the ilia. Marked osteophytic reaction was present in the region of

the laminae and spinous process of the fifth lumbar vertebra. The lateral articulations at the lumbo-sacral juncture were in a transverse vertical plane. The lateral view showed the fifth lumbar vertebra displaced slightly anteriorly on the first sacral. Moderate thinning of the intervertebral disc was evident. A line $\frac{1}{4}$ inch wide indicated solution of bony continuity through interarticular region (isthmus) of laminae of the fifth lumbar vertebra.

This patient has not returned for further study. A letter received during August 1930 states that his back condition remains about the same. He is able to carry on in his work as a minister. No treatment of his back has been instituted at any time.

CASE 11. J. D. An anteroposterior roentgenogram showed that the body of the fifth lumbar vertebra overhung that of the first sacral. The spinous processes of the fourth and fifth lumbar vertebrae overlapped that of the fourth being anterior and displaced distally. A lateral roentgenogram showed that the body of the fifth lumbar vertebra was displaced one half of its diameter anteriorly. The intervertebral disc was very thin. The inferior surface of the body of the fifth was concave and conformed to the proximal surface of the first sacral. A gap one half inch in width was present in the region of the isthmus. The spinous process remained in its normal relation to the sacrum.

CASE 12. J. P. white schoolboy of 13 years was admitted to Northwestern Medical School Dispensary January 31 1930. He had pain in the lumbar region and legs which he noticed after standing for short periods. For the past several months he has had increasing low back disability associated with pain radiating to the anterior and lateral aspects of both thighs. There was no history of any definite trauma associated with the onset of this condition. Symptoms were aggravated by standing for short periods and were modified by varying physical activity. Complete freedom from discomfort occurred only when the patient was in the recumbent position.

Examination revealed a boy of slender physique. A high lordosis was present. The sacrum was unduly prominent. Motion of the lumbar spine was restricted in all directions. The lower extremities were normal. The reflexes were not pathological.

Roentgenograms were taken February 2 1929. The anteroposterior view revealed a defective fusion of the laminae in the midline resulting in a spina bifida of the fifth lumbar and entire sacrum. The lateral articulations at the lumbosacral juncture could not be outlined. Both sacro iliac joints were wide but normal for this age. The lateral view showed an increased lordosis present in the lower lumbar spine. The superior surface of the sacrum was nearly vertical. The fifth lumbar vertebra was displaced anteriorly on the first sacral $\frac{1}{4}$ inch. The intervertebral disc at this level was very narrow posteriorly. The sacral bodies were not fused.

A defect involving the (isthmus) interarticular area of the laminae was present showing lack of bony

This patient left the hospital after a few days and cannot be located for more details of his condition.

CASE 8. L. R. white female aged 13 years. American student. Patient had difficulty in walking and pain in the lumbar region and in both thighs. In December 1909 while carrying her arms full of groceries she slipped on the icy sidewalk. In falling she tried to prevent breaking her wrist watch and bottle of milk which she was holding. She struck the sidewalk in a semireclining and sitting position. She was very much frightened but was able to get up and carry her bundles home. The acute discomfort in the lumbar region soon subsided and after several days disappeared. There was no particular discomfort until June 1930. While sitting in school she had a sudden onset of the oblique and shooting pain in the lumbar region. She can recall any unusual strain of lumbar region immediately preceding the attack. She continued with her school work for a day and then she remained at home because of pain in the lumbar region which was greatly aggravated by walking. The discomfort increased on activity and was relieved only by rest in bed and the use of a pelvic binder. There was no history of lumbar or sciatic pain previous to the injury. Her general health had been excellent. There had been no symptoms referable to cardiovascular, gastro-intestinal, genito-urinary or neuromuscular systems.

Examination revealed temperature of 99 degrees, pulse 60, blood pressure 102-5 (See photograph). General examination revealed no abnormality other than that of the lumbar pain. The lumbar spine as held partially flexed with lumbar lordosis obliterated thus causing undue prominence of the spinous processes of the entire lumbar area. There was marked spasm of the lumbar muscles. Lateral bending as farly free but flexion and extension were definitely limited by muscle spasm and pain in the lumbar region and in both thighs. Standing posture with upper extremities showed normal range of motion in all joints except that hyperextension of the thighs was restricted by lumbar pain. Reflexes were normal, no sensory changes were present. The urine a straw-colored specific gravity of 1.020, albumin 5 milligrams per 100 cubic centimeters and a few leucocytes and epithelial cells. There were 660,000 red blood cells, 800 white blood cells and hemoglobin 64 per cent.

Röntgenograms were taken July 10, 1930. The anteroposterior view showed the lumbar spine and sacral regions normal except for a midline defect of the posterior arches of the entire sacrum. The laminae and spinous process of the fifth lumbar vertebra were definitely narrower and more sclerotized than those of the next level, p. o. ximal. The lateral view showed the sacrum quite horizontal but the superior surface made about a 45 degree angle by a marked overdevelopment of the anterior margin. A definite lack of bony continuity as present in the interarticular or isthmus region. This line was

about one half inch in width. No anterior displacement of the fifth lumbar was present in this position.

Operation was performed August 16, 1930. A midline incision was used. A Hibbs dissection exposed the third lumbar to the second sacral spinous and laminae. The spinous process of the fifth lumbar was rather prominent and moved without relation to the body of the fifth lumbar vertebra. A line of fracture or lack of bony continuity was present in the interarticular region on both sides. A midline defect was found at the first sacral level. After a careful dissection bone chips were turned down from the exposed laminae. This was reinforced by a graft from the crest of the left ilium.

Trauma was directly related to the onset of symptoms. The mechanism of the force acting on the isthmus was one of a shearing strain on a moderately inclined sacral surface increased by flexion of the lumbar spine. The inertia of the superimposed weight was augmented by contraction of the trunk muscles. A relatively free period intervened between the original disability following trauma in December 1909 and the acute symptoms coming on without inciting trauma in June 1930.

A typically loose posterior neural arch was found at operation.

Very recent (January 1931) observation of this girl indicates complete relief of symptoms.

CASE 9. M. A. female aged 28 years housewife complained that pain in the posterior aspects of the right and left legs had been present for 3 years. When without injury or warning patient began to have pain in the right lower quadrant of the abdomen and down the posterior aspect of the right leg. An appendectomy was done at that time which resulted in relief of the abdominal pain. The right sciatic pain persisted during all forms of activity but was relieved when patient rested in the horizontal position. About a year ago a similar pain developed in the left lower abdomen and radiated down the left sciatic region. The discomfort in both legs was always increased by standing or prolonged walking. Other than for the discomfort this patient was in excellent health. General physical examination as essentially negative. The back was well formed and straight. Deformities tenderness was present on pressure over the spines of the fourth and fifth lumbar vertebrae. Movement of the spine was distinctly limited in all directions throughout the lumbar area. Extension caused increased discomfort down the posterior aspects of both legs. Both lower extremities showed no impairment of function or abnormal reflexes. Straight leg bending was restricted on both sides. The urine was normal. The red blood cell numbers 1,300,000, hemoglobin was 66 per cent, white blood cell 6,800.

Roentgenograms were taken on October 22 1928. In the anteroposterior view six lumbar vertebrae were present. An angulation suggesting a slight displacement to the right was present at the lumbosacral juncture. The bone at this level was somewhat sclerotic. Both sacro iliac joints showed slight lipping at their lower margins. The lateral articulations were in a transverse vertical plane. The lateral view showed the sixth lumbar vertebra displaced about $\frac{1}{4}$ inch anteriorly on the first sacral and angulated and displaced slightly forward in relation to the body of the fifth. The relation of the spinous process seemed to be normal. A rather indefinite line indicated solution of bony continuity through the interarticular (isthmus) region of the laminae of the sixth lumbar vertebra. Slight narrowing of the intervertebral space was present.

Operation was performed October 30 1928. A Hibbs fusion operation was done the spine being fused from the third lumbar to the second sacral inclusive and reinforced with osteoperiosteal graft from the tibia. The spine and posterior arch of the fifth lumbar vertebra were found to be extremely mobile and not attached to the vertebral body by other than soft tissue in the region of the isthmus on either side. A low grade infection of the wound developed but cleared at an early date.

Recent reports from this patient indicate that stabilization by fusion has entirely relieved her of low back and sciatic pain. The result is excellent.

No definite association of trauma with the onset of symptoms could be established in this case. Bony fixation has given complete relief.

CASE 10 H B male aged 32 years white student. Patient had pain in the right lumbosacral region and in the right testicle. When 14 years of age he first noticed a burning sensation in the right lower lumbar region after shocking corn. There was no history of a distinct trauma at this time. This discomfort had continued until the present time and had varied considerably as to intensity. At present the pain radiates down the posterior aspect of the right leg. The testicular pain was attributed to a direct injury at the age of 17 years. Six months ago he was under observation in a Chicago hospital because of the low back pain and sciatica but no diagnosis was made. General history revealed no other essential facts relative to his back condition.

Examination showed the pelvis tilted slightly to the right. The lumbar spine was deviated to the right. Definite restriction of lumbosacral flexion was present. Some tenderness was noted in the midline at the lumbosacral juncture. Reflexes were normal. The blood Wassermann was negative the urine was negative. Roentgenograms were taken February 11 1927. The anteroposterior view showed marked sclerosis in both sacro iliac joints especially in the region of the articular surface of the ilia. Marked osteophytic reaction was present in the region of

the laminae and spinous process of the fifth lumbar vertebra. The lateral articulations at the lumbosacral juncture were in a transverse vertical plane. The lateral view showed the fifth lumbar vertebra displaced slightly anteriorly on the first sacral. Moderate thinning of the intervertebral disc was evident. A line $\frac{1}{4}$ inch wide indicated solution of bony continuity through interarticular region (isthmus) of laminae of the fifth lumbar vertebra.

This patient has not returned for further study. A letter received during August 1930 states that his back condition remains about the same. He is able to carry on in his work as a minister. No treatment of his back has been instituted at any time.

CASE 11 J D. An anteroposterior roentgenogram showed that the body of the fifth lumbar vertebra overhung that of the first sacral. The spinous processes of the fourth and fifth lumbar vertebrae overlapped that of the fourth being anterior and displaced distally. A lateral roentgenogram showed that the body of the fifth lumbar vertebra was displaced one half of its diameter anteriorly. The intervertebral disc was very thin. The inferior surface of the body of the fifth was concave and conformed to the proximal surface of the first sacral. A gap one half inch in width was present in the region of the isthmus. The spinous process remained in its normal relation to the sacrum.

CASE 12 J P. white schoolboy of 13 years was admitted to Northwestern Medical School Dispensary January 31 1930. He had pain in the lumbar region and legs which he noticed after standing for short periods. For the past several months he has had increasing low back disability associated with pain radiating to the anterior and lateral aspects of both thighs. There was no history of any definite trauma associated with the onset of this condition. Symptoms were aggravated by standing for short periods and were modified by varying physical activity. Complete freedom from discomfort occurred only when the patient was in the recumbent position.

Examination revealed a boy of slender physique. A high lordosis was present. The sacrum was unduly prominent. Motion of the lumbar spine was restricted in all directions. The lower extremities were normal. The reflexes were not pathological.

Roentgenograms were taken February 2 1929. The anteroposterior view revealed a defective fusion of the laminae in the midline resulting in a spina bifida of the fifth lumbar and entire sacrum. The lateral articulations at the lumbosacral juncture could not be outlined. Both sacro iliac joints were wide but normal for this age. The lateral view showed an increased lordosis present in the lower lumbar spine. The superior surface of the sacrum was nearly vertical. The fifth lumbar vertebra was displaced anteriorly on the first sacral $\frac{1}{4}$ inch. The intervertebral disc at this level was very narrow posteriorly. The sacral bodies were not fused.

A defect involving the (isthmus) interarticular area of the laminae was present showing lack of bony

containing for a space of about $\frac{1}{2}$ inch. The angle of the first sacral surface is 60 degrees.

Further observation of the patient has been impossible because of his failure to co-operate.

CASE 13. H. M. white female, aged 33 years, housewife married. Patient complained of low back pain of 11 years duration, a deformity of the lower spine of 11 years duration and parasthesias of the right leg for 7 years. She was perfectly well until 11 years ago when she fell from the top of a 16 foot ladder. She does not remember details of fall or her position on striking the floor. She was able to get up and continue her work. She was pregnant at the time of her fall and delivered a full term child one week later. Since her injury she has had considerable low back pain and has noticed the gradual development of a hard tumor in the region of her lower spine. She first sought medical care during May 1930. A series of local treatments of radiant heat gave no relief. She was then referred to Dr. P. C. Ritté and admitted to Orthopedic Clinic of St. Luke's Hospital.

During the past few weeks there has been a marked exacerbation of low back pain and numbness and clonus in her right leg. There was also some temporary paralysis of the extensors of the toes on the right. Her general medical history revealed no significant facts. Since her injury she has had two normal pregnancies. Three children 6, 8 and 12 years old respectively are living and well. There is no history of bladder disturbance.

Examination disclosed a small white woman appearing older than her given age. Her general health seemed good. She was rather slow in responding to questioning. General examination revealed no essential findings other than slight thyroid enlargement and a moderately relaxed abdomen.

Examination of the spine revealed a marked shortening of the entire trunk with the lower ribs closely approximating the crests of the iliac bones. The abdomen was prominent. A moderate degree of lordosis was present. The gluteal areas were prominent and appeared high. There was a very definite bony prominence in the midline at the upper sacral level. Proximal to this prominence was an abrupt depression forming a rather abrupt loss in the lower lumbar region. On pressure over the lower spine posteriorly no tenderness was elicited. The patient indicated the location of her pain as a transverse area extending to the region of both sacroiliac joints. Both knee jerks were present and normal. Babinski reflexes were absent. Both legs showed no marked joint function with the exception of deformities of all toes due to tight shoe. The urine was normal. The white blood cells numbered 15,000; red blood cells 4,200,000; hemoglobin 80 per cent.

Röntgenograms were made July 7, 1930. The anteroposterior view showed a marked spondylolisthesis present with the body of the fifth lumbar vertebra on the first sacral. Marked sclerosis about the laminae and articular processes was present with some osteophytic change. Both sacroiliac joints

were sclerosed. The lateral view showed the body of the fifth lumbar vertebra displaced anteriorly two thirds of its diameter and overhanging the first sacral and projecting into the pelvic inlet. The anterior half of the first sacral surface was deficient as was the opposing posterior surface of the fifth lumbar body. The intervertebral disc was very thin and irregular. There was little evidence of bone proliferation at this level.

The spinous process and inferior articulations of the fifth remained in their normal relation to the sacrum. The entire fourth and proximal vertebrae had their normal relation to the fifth and had followed in its anterior displacement. The spinous process of the fifth remained behind and was unusually prominent.

A bony defect of 1 inch was present in the interarticular (or isthmus) region of the laminae.

The angle of the first sacral surface is 65 degrees. Operation was performed July 9, 1930. A posterior midline incision was made and the spinous processes and laminae of the third lumbar to the first sacral were exposed by subperiosteal dissection. All ligamentous tissue was removed as was the cartilage of the lateral articulations. The spinous process of the first lumbar vertebra was found to be in a position about 1.5 centimeter posterior to a line of the proximal spine. This spinous process with both laminae and inferior articular processes moved freely as a unit through the interarticular area (isthmus) and on freeing the soft structures was removed from the wound. Because of the close approximation of the posterior arch of the fourth lumbar vertebra to the arch of the first sacral this fragment was not replaced. Bone chips were removed from the exposed surfaces of bone and shingled across the interlaminal spaces. Two generous osteoperiosteal grafts from the left tibia were then placed over this entire area.

The postoperative course was uneventful and the patient was discharged on the forty-second day wearing a reinforced fabric corset.

Acute low back symptoms followed directly after a fall when the patient was near term of her first pregnancy. This injury was followed by a gradually increasing anterior displacement of the fifth lumbar vertebra upon the first sacral surface. The area of bone separation in the region of the isthmus gradually increased permitting the spinous process of the fifth lumbar vertebra to remain behind and due to its prominence appear as the tumor noted by the patient. The gradual anterior displacement at the lumbosacral level suggests the low yielding of soft structures brought on by prolonged and excessive strain. This unique specimen points more to fracture than to developmental separation in the isthmian region.



Fig. 36 Case 13 Aged 33 years Lost traumatic podylolisthesis showing typical tumor consisting of detached spinous process and lamina



Fig. 37 Specimen removed from Case 13 Arrow points to the cleft at left of isthmus

These symptoms have gradually grown worse until now he is unable to walk over a few blocks without stopping to rest. General and past history are otherwise negative.

Examination revealed a well nourished and well developed boy of 15 years not acutely ill or in pain. There was marked prominence of the spinous process of the fifth lumbar in the midline depression of the third and fourth in relation to the fifth and marked muscle spasm. Flexion and lateral bending were restricted by increasing pain in both sciatic areas.

Straight leg flexion of hip caused sciatic pain. Knee jerks normal. Temperature 98 degrees pulse 80 respiration 22.

Roentgenograms were taken. The anteroposterior view showed the body of the fifth lumbar vertebra overhanging that of the first sacral. The spinous process of the fifth remained in normal relation to

CASE 14 H P white male aged 15 years student. Patient complained of pain in the lumbosacral region with radiation down both legs especially the right sciatic area. This pain had been present for 2 years. The patient dates his trouble from the time of accident about 2 years ago. He was riding on a harrow when his team of horses ran away. He was thrown against a fence post on his back. He suffered acute pain which persisted. After the acute condition subsided he noticed that walking or riding on a wagon caused an increasing pain down the posterior aspect of his legs especially the right. This would subside in a few minutes on lying down.

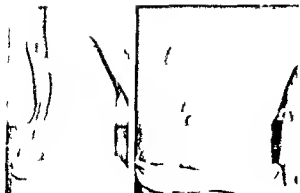


Fig. 38 left X-ray tracing Case 13

Fig. 39 Roentgenograms Case 13 Lesion of isthmus



with third degree spondylolisthesis (See operative findings also Fig. 37)



F 4 C s 4 A d 55 T mat co
f y p d t B y t mo t l mb sa l
j t p d t b l t h d p ou p ess d l m
f l t l m t t l (S e o p t)

those of the proximal lumbar vertebra. This spinous process was moderately atrophic except in the region of the isthmus on either side where there was marked sclerosis. The lateral view showed the proximal surface of the first sacral to be convex especially at the anterior margin. The body of the fifth and the proximal vertebrae were displaced anteriorly 1/8 inch. The spinous process of the fifth remained in normal relation to the first sacral. Separation of the isthmus of the fifth was undoubtedly present. There was an irregular line at the isthmus of the fourth suggesting lack of bony continuity but without separation.

Operation was performed September 19, 1930 by Dr. E. W. Rivers and Spinefus and dissection was done

The prominent spine of the fifth was in normal relation to the sacrum which showed a slight spina bifida. The spine of fifth was well formed. There was free mobility at the isthmus on either side. The spines of the fourth and third were in normal relation to the fifth. Fragments of spinous process were overlapped and reinforced by a graft from the left iliac crest.

In this case the symptoms and the anterior displacement of the fifth lumbar were produced by the severe trauma which occurred when the patient was 13 years of age. Further slipping followed. The spinous process had not advanced with the body of the last lumbar but remained behind producing a typical tumor so frequently seen in similar cases of marked spondylolisthesis. The lateral roentgenogram suggested a similar lesion of the isthmus of the fourth lumbar vertebra. At this level no separation of fragments occurred. The mechanism favoring this separation was entirely lacking inasmuch as the fifth lumbar offered no resistance because of its own mobility. Excepting for the marked spondylolisthesis the findings in this case were very similar to those of the specimen described earlier in this paper. A recent report from this patient states that he is perfectly well and is doing hard work on the farm.



F 4 l ft Tra g m d f th ro tg g m
C se 4

F 4 R tg g m C 4 L f th m
Th d deg po dyl f th (S perat n d ng)

CASE 15 L. H. white female aged 36 years housewife entered the hospital on August 30 1930 complaining of pain and weakness of the legs which had gradually increased during the past 5 years. About 5 years ago the patient began to have pain which radiated down the posterior aspect of her legs to the dorsum of her feet alternating from side to side and varying greatly in intensity. The onset was gradual and not associated with any definite trauma. This condition continued until 3 years ago. At that time while stooping to get under a barbed wire fence she felt something snap in her back. She experienced great difficulty in walking and returned home with assistance going directly to bed. During the next 2 years she spent much of the time at home and in bed. At intervals she was able to get up and walk for short distances. Excitement and emotion aggravated the condition. There was no actual pain. On attempting to walk her ankles would turn over she had difficulty in dorsiflexing her feet. Numbness and tingling were present at intervals. A diagnosis of lues apparently was made for she received intermuscular injections over a period of several months.

In October 1929 she experienced occasional involuntary movements of her lower extremities which lasted for periods of an hour to a day or two. This finally let up and she was able to walk again.

About November 15 1929 while excited and angry her legs gave way under her and she was carried to bed. She has not walked since. For the past 3 months there has been continuous aching pain in the right ankle and foot and for the last month similar pain in the left foot. She has not been conscious of any disturbance of sensation.



FIG. 43. Case 1. Aged 36 years. Marked spondylolisthesis with bilateral peroneal paralysis. Tumor in midline at lumbosacral juncture proved to be spinous process and lamina of last lumbar vertebra.

Other than for some urinary frequency and occasional nocturia her general history was negative.

Examination revealed a normal dorsal spine. There was a slight scoliosis to the left in the lumbar region with a rather deep V shaped depression in the midline over the spinous processes of the upper four lumbar vertebrae. Over the dorsum of the fifth lumbar vertebra there was a sharp bony prominence about 1 inch in height. The sacrum was unusually prominent. Motions of the lumbar spine were fairly

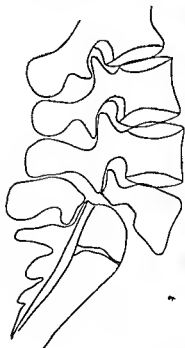


FIG. 44. 1 ft. Tracing made of the roentgenogram in Case 15.

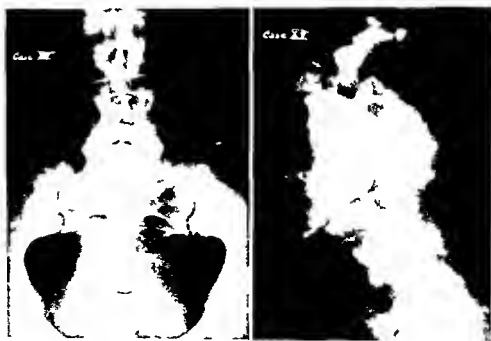


FIG. 45. Roentgenograms Case 15. Lesion of isthmus with third degree spondylolisthesis.

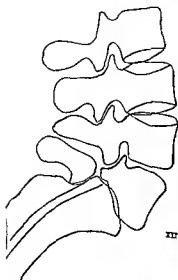


Fig. 46. Lateral view of the lumbar spine showing a fracture of the twelfth rib.



Fig. 47. Anteroposterior and lateral views of the thoracic spine showing a fracture of the twelfth rib.

flexion which was definitely restricted the abrupt lordosis being present constantly. Direct pressure over the lumbar spine revealed no tenderness. The abdomen was soft and very relaxed. The iliac crests were high giving the appearance of some telescoping of the trunk. Both legs were atrophied. A marked bilateral foot drop was present. Knee

jerk and Achilles reflexes were absent. Some tenderness was present over the dorsum of the left foot and the lateral aspect of the left ankle. The general examination was otherwise essentially negative except for some inequality of pupil and rather sluggish reaction to light.

Röntgenograms were made on September 2, 1930. The anteroposterior view revealed a transverse fracture of the twelfth rib on the right with



Fig. 48. Lateral view of the lumbar spine showing a fracture of the twelfth rib.

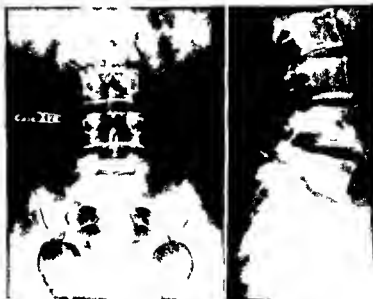
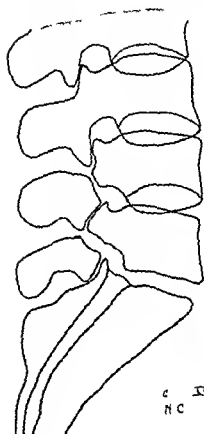


Fig. 49. Anteroposterior and lateral views of the thoracic spine showing a fracture of the twelfth rib.



F 50 \ ray tracing Case 18



51 51 Roentgenograms Case 18 Lesions of isthmus of fourth and fifth lumbar vertebrae Compare with Figure 7

an excessive amount of callus. The intervertebral disc between the first and second lumbar vertebrae was definitely thin and the adjacent body margins showed marked osteophytic reaction forming dense spurs especially on the superior lateral margins of the second lumbar body. The lumbosacral juncture showed marked sclerosis which obliterated bone detail at this level. The pelvis hips and sacro iliac joints showed no pathology. The lateral view revealed thinning of the disc between the first and second lumbar bodies and the osteophytic reaction at this level was evident. The body of the fifth lumbar vertebra was displaced anteriorly on the first sacral two thirds of its diameter. The intervertebral disc could not be outlined. The posterior inferior margin of the body of the fifth showed a marked erosion allowing the fifth lumbar vertebra to telescope over the first sacral body one half of its vertical diameter. The superior surface of the sacrum was rounded corresponding to the deficient area of the fifth lumbar body. The spinous process of the fifth lumbar was very prominent posteriorly projecting $\frac{3}{4}$ inch posterior to that of the fourth. A bony defect $\frac{3}{4}$ inch wide was present in the interarticular or isthmus region of the laminae. Instead of the usual concave anterior surface of the sacrum this was slightly convex.

Results of laboratory examinations were as follows

August 30 1930 urine normal red blood cells 4,410,000 white blood cells 4,450 hæmoglobin 88 per cent

September 4 1930 Wassermann and Kahn (blood) negative with all antigens

September 9 1930 white blood cells 8,100 lymphocytes 44 polymorphonuclears 54 monocytes 1 eosinophil 1 spinal fluid clear 3 cells Globulin Ross Jones very faintly positive Landy faintly positive Wassermann negative colloidal gold reaction 0000000000

September 12 1930 urine normal bladder urine culture by Dr H Culver showed no growth

Several consultants examined this patient and their findings are summarized as follows

August 30 1930 Dr R I Mackay possible diagnosis of I Syphilis of central nervous system II Cauda equina lesion with peroneal and calf atrophy due to syphilis or spondylolisthesis

September 8 1930 Spinal puncture pressure 80 millimeters to 115 millimeters On pressure to jugular veins 170 millimeters on release of pressure 105 millimeters No block present

September 10 1930 Dr G W Hall Cauda equina lesion following injury with but little hope of regeneration of nerves of cauda cystoscopy recommended for possible cord bladder

September 11 1930 Dr H Culver Cystoscopic examination conclusions There are no local findings suggesting a neurogenic bladder but there is some evidence of obstruction at outlet No treatment indicated

September 12 1930 Dr H O Jones Moderately lacerated perineum and anterior wall No treatment indicated

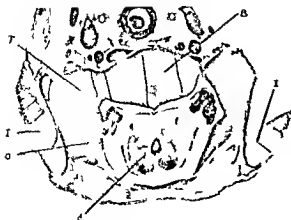


Fig. 53. Hottelset off the body of the fifth lumbar vertebra. The body of the fifth lumbar vertebra is 57 mm. in height. The body of the first sacral vertebra is 70 mm. in height. The body of the first sacral vertebra is 70 mm. in height. The body of the first sacral vertebra is 70 mm. in height.

Operation as performed on September 17, 1930. A midline incision was made and a subperiosteal dissection from the second lumbar to the sacrum was done. The spinous process of the fifth lumbar vertebra a high spinous prominent process to operation as found to be very freely movable in all directions not on occurring at the level of the isthmus on either side. The entire lumbar process could be easily removed upon the same. Bone bridge after Hibbs method were turned over the entire operative field from the second lumbar to the first sacral vertebra. A large transplant was taken from the posterior crest of the left lumbar infusing the area between the fourth and fifth lumbar and first sacral vertebrae.

Postoperative course. The patient showed a very slight general reaction. Some frequency of urination as present. The wound healed per primam and stitches were removed on the eighth day. On the fourteenth day after operation a marked urinary retention developed and after perineal catheterization the patient felt a shock and died within 2 hours. Autopsy was refused.

In Case 15 the neurological findings predominated. No definite relation to trauma had been established. Severe spondylolisthesis was unquestionable in this case and the lesion of the isthmus was readily demonstrable in the roentgenogram and was confirmed at time of operation. The tumor of severe spondylolisthesis of this type was present. The destruction of the inferior surface of the displaced body of the fifth lumbar vertebra and the configuration of the superior surface of the first sacral body were evidence of the absence of reparative processes or the total

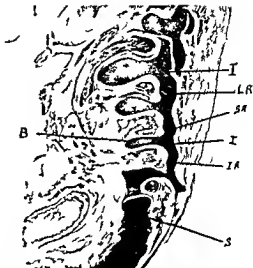


Fig. 53. Sagittal section of the fifth lumbar vertebra and the first sacral body. The body of the fifth lumbar vertebra is 57 mm. in height. The body of the first sacral vertebra is 70 mm. in height. The body of the first sacral vertebra is 70 mm. in height.

inability of cancellous bone to resist such unusual strains of weight bearing and motion.

CASE 16. J. F., white male, aged 49 years, carpenter, was admitted to the hospital June 12, 1930. His chief complaint was pain in low back. About 10 years ago while at work as a carpenter he slipped and fell a short distance striking on his buttocks. He experienced immediate pain in his low back but continued his work for several days. Since this injury he has had frequent attacks of disabling low back pain and has been unable to stand the lifting and overhead work of his trade. There has been some disturbance of bladder function.

Examination revealed a normal genito-urinary tract. No abnormality of the back or lumbar spine was noted. Motion seemed to be normal in all directions. The lower extremities were normal.

Roentgenograms were taken. The anteroposterior view showed the body of the fifth lumbar vertebra slightly eroding that of the first sacral. The spinous process of the fifth was rather high and as part of it overlapped by the spinous of the fourth lumbar vertebra. The lateral view showed the body of the fifth lumbar displaced one-half inch anteriorly on the first sacral vertebra. The spinous process of the third, fourth and fifth were in close approximation and those of the third and fourth were somewhat anterior to the spine of the fifth lumbar. The latter was normal in relation to the sacrum. There was lack of bony continuity at the isthmus of the fifth lumbar.

The patient has not returned for further observation and treatment. When last heard from he was able to do light part-time work.

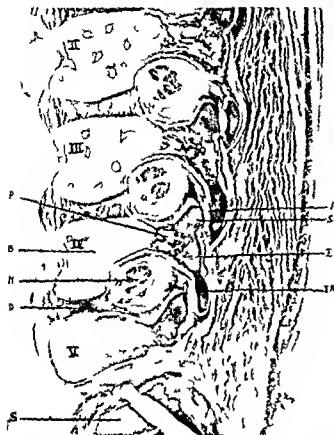


FIG. 54. Sagittal section of lumbar spine of female fetus crown rump length 133 millimeters. D Intervertebral disc P pedicle B vertebral body N nerve root SA superior articular process I isthmus (pars interarticularis) of lamina IA inferior articular process A articular (lateral)

but unable to return to his regular work as a carpenter because of low back discomfort occasioned by lifting

CASE 17. M. C. male aged 51 years. His chief complaint was pain in low back. For many years he has had transient pains in the lower lumbar region. During the past few weeks these have become definitely worse. Low back discomfort is always associated with physical activity and relief is obtained by resting in horizontal position. No history of a definite injury involving the lower spine region was obtained.

Examination. The records of this case do not describe the appearance and function of the low back.

Roentgenograms were taken and the anteroposterior view showed the lumbar vertebra of normal outline and density. The spinous process of the first sacral was bifid. The spinous process of the fifth lumbar vertebra was less developed than those proximally. Irregular areas of sclerosis were present in the region of the isthmus on either side. The lateral view showed the vertebra of the lumbar spine normal excepting for a rounded bony projection on

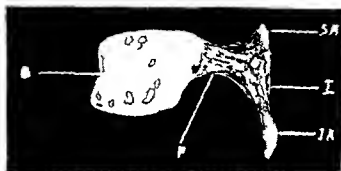


FIG. 55. Photomicrograph showing ossification at isthmus and pedicle. B Body P pedicle SA superior articular process I isthmus IA inferior articular process

the anterior superior aspect of the body of the fourth. This was suggestive of an old fracture of this area. The body of the fifth was displaced about $\frac{1}{4}$ inch anteriorly on the first sacral surface. The isthmus of the lamina showed a definite loss of bony continuity. The bone on either side of this cleft was sclerotic.

The case history is of little use because of the scant attention paid to the diagnostic signs and the accurate story of low back symptoms. This case is included in this series because of the demonstrable lesion at the isthmus. The roentgenograms were made available through the courtesy of Dr. E. L. Jenkinson, roentgenologist at St. Luke's Hospital.

CASE 18. N. C. male aged 49 years, janitor. Patient complained of low back pain with radiation to both thighs anteriorly and left sciatic. He had been in good health until April 1930. When attempting to lift some lockers which were fastened to the floor something gave way in his lower back, pain radiated down the posterior aspect of the left leg. Patient was unable to continue work and received local treatment to his back as well as weeks of recumbency in a hospital. The pain varied considerably in intensity and during the past few weeks has been improving.

Examination of the patient while standing showed the spine partially flexed and obliterating the lumbar lordosis. There was a slight list to the left in the lumbar region. Motion in all directions was very limited. Moderate muscle spasm was present. Local tenderness was present in the midline and over the posterior aspect of the left sacroiliac joint. Atrophy of the left leg was very evident. Hip, knees and ankles were normal. Knee jerks were sluggish. Babinski was normal.

Roentgenograms were taken and the anteroposterior view revealed oblique clefts at the margins of the superior lateral articular facets present on either side of both the fourth and fifth lumbar vertebra. The body of the fifth lumbar vertebra appeared to

be narrowed in its vertical diameter The lateral view revealed definite clefts present in the isthmus of both the fourth and fifth lumbar vertebrae The normal lordosis as present

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EXPERIMENTAL OBSTRUCTION OF THE TERMINAL DUODENUM AND ILEUM

THE IMPORTANCE OF BLOOD CHEMICAL CHANGES IN CAUSING DEATH¹

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(With Technical Assistance of Miss M. E.)

THE following observations are an extension of our previous studies (3, 13) on the chemical changes in the blood of dogs following loss of gastro intestinal secretions. The object of the paper is to present additional evidence for the belief (1) that the chief factor in the production of the so called 'toxemia' and death following obstruction of the terminal duodenum is to be found in the chemical changes in the body fluids due to loss of gastro intestinal secretions and (2) that the fatal termination when associated with obstruction in the terminal ileum must be explained in another manner.

REVIEW OF LITERATURE

The older literature in general discussed without differentiation all simple obstructions noting only the well observed fact that the higher the obstruction the more rapid the death and more toxic the symptoms. This was explained in various ways depending on whether the theory of toxemia, infection or reflex action was assumed to be the mechanism causing death. A thorough review of these theories may be found in the paper of Enderlen and Hotz.

The first attempt to discard the toxemia explanation of the cause of death in cases of high intestinal obstruction was made by Hartwell and Hogue who in 1912 advanced the idea that loss of fluids by vomiting was the cause of death after occlusion of the pylorus or duodenum. They demonstrated that dogs with pyloric or duodenal obstruction could be kept alive for long periods with saline infusions given to restore lost fluids or by withholding food and water and in that way reducing vomiting with its associated loss of gastro intestinal secretions. They made no chemical studies of the blood concerning the role of dehydration they believed however that the symptoms of intoxication are those

resulting from tissue disintegration following this loss (of water). The importance of the salts in the lost vomitus was not mentioned. It should be noted however that W. G. MacCallum in experiments beginning as early as 1909 really was the first to maintain that death after pyloric obstruction was a purely chemical one due to loss of gastric juice by vomiting. It was not until 1920 (16) however that all the evidence was published. In the publication of that data the observation of the development of low chloride content and high carbon dioxide combining power of the blood after pyloric obstruction and their return to normal with injections of saline solution was reported. McCann in 1918 had previously reported that alkalosis followed pyloric occlusion or fistula but did not explain its significance although he suggested the possibility that it might be due to the loss of acid gastric juice. Hastings, Murray and Murray confirmed the findings of MacCallum and in addition determined the hydrogen ion concentration of the blood which they found normal or slightly more alkaline than normal.

Attention particularly from the therapeutic viewpoint was redirected to chemical changes in the blood by the extensive observations of Haden and Orr beginning in 1913 (7). They emphasized the depletion of blood chlorides after high intestinal occlusion and showed the beneficial effect of saline infusions. They still adhered however to the toxemia theory and assumed that the blood chlorides were low because they were bound in the tissues by toxin originating in the intestinal tract. An hypothesis they have since forsaken (8). Gamble and Ross (5) in 1925 demonstrated conclusively by analysis of the vomitus that the blood chemical changes occurring in dogs with pyloric obstruction were due to loss of gastric juice. They also pointed out that even though

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TABLE I—DATA FROM DOGS WITH HIGH INTESTINAL FISTULA (F) OR OBSTRUCTION (O)

| Dog (F) (O) | Date | Diet | | Blood | | | | | | | | | | Remarks |
|----------------|----------------|----------------|------|-------|-----------------|------|-----|------|----|-----|------|------|------------------|-----------------------|
| | | Blood count | Diet | Urea | CO ₂ | Cl | Ca | Na | K | La | Trig | Uric | HCO ₃ | |
| Nm | | | | 600 | 55 | 7 | 5 | 5 | 5 | | | | 93.4 | 3 |
| 15 (F) | | | 3 | | | | | | | | | | | At tm t |
| 348 (F) | | | 3 | | | | | | | | | | | At tm t |
| B3 (F) | | 3 | 4 | 53 | 38.3 | 3 | (1) | 6 | 3 | 3 | 9.4 | 100 | | At tm t |
| A15 (F) | 0-0-3 4 PM | | | 33 | 48.5 | 4 | 7 | | 16 | 3.0 | 89.8 | 84 | | At tm t Bl d t k t |
| B5 (O) | 0-24 9 | 3 | | 44 | 84.4 | 6.63 | (6) | 57.9 | 4 | | 9 | 39 | | D g ec d s m phy |
| | 0-5 9 | 4 | 8 | 3 | 96 | 6 | (8) | 7 | | | 9.6 | 87 | | th sp tsly se o |
| | | | | | | | | | | | | | | th t dat |
| 33 (O) | 0-4 9 9 AM | 3 | | 64 | 56 | 5.3 | 6.9 | 6 | 53 | 0.4 | 94.9 | 2 | | |
| | 0-9 9 9 AM | 6 | | 45 | 85.3 | 67 | 6 | 6 | 0 | 3 | 93.7 | 34 | | |
| | 0-10 9 9 AM | | | 69 | 86.9 | 7.44 | 7 | 3 | 0 | 8.0 | 93 | 60 | | |
| | 0-11 9 9 AM | 8 | | 4 | 85.8 | 5.5 | 3 | 45.3 | td | | 94.9 | 5 | | S t t d Chart f d t l |
| | 0-12 9 9 AM | 5 | | 468 | 8 | 3.95 | 3 | 6 | 35 | 8 | 95.8 | 7 | | |
| | 0-13 9 9 AM | 3 | | 450 | 7 | 3.96 | | 0.4 | 3 | 4 | 95.5 | 6 | | Gl 37 mg p t |
| | 0-14 9 9 AM | 5 | | 480 | 70 | 3.66 | | 3.9 | 33 | 8.4 | 95 | 5 | | Gl 37 mg p e t |
| | 0-15 9 9 AM | 6 | | 1 | 67 | 3.96 | | 3.8 | | | 9.5 | 6 | | Gl 37 mg p m t |

() 1 mdf cl l u f t a l c d

E t m a t d f o m p t t a

S m a s t h m b d l d e r b d u r s v i p p l t h e s o m e n t s t w a s e n s p t g l

grams per cent in dog B3 and to 184 milligrams per cent in dog A15 (5) marked increase in inorganic phosphorus (to 17 milligrams per cent in dog A15) (6) reduction in total base, moderate in dog B3 (to 135 millimols) and very marked in dog A15 (to 116 millimols) and (7) slight increase in lactic acid (to 26 milligrams per cent in dog B3).

From previous study of the effects of total loss of either gastric or pancreatic juice we can explain these findings rather simply as follows: both gastric and intestinal secretions contain sufficiently large amounts of fixed base and chloride to cause significant reduction of these substances in the blood and other body fluids since the secretory mechanism tends to continue the pouring out of juices of fixed composition regardless of the chemical

composition of the blood, the most important secretions gastric and pancreatic juices have a greater water content than does blood plasma and their continual secretion and loss together with evaporation of water from the lungs leads to reduction in the water content of the plasma, the latter leads to diminished blood volume and flow which causes (1) anoxemia with resultant lactic acid increase and (2) oliguria with resultant retention of non protein nitrogen and inorganic phosphate the retention of phosphoric acid (and undoubtedly sulphuric acid also) and the accumulation of lactic acid lead to reduction in carbon dioxide content (acidosis).

The appearance of the animals with duodenal fistula is characteristic the skin and mucous membranes become dry and the

typical blood chemical changes occurred in rabbits with pyloric obstruction in the absence of vomiting gastric juice was just as effectively lost to the body when it remained in the stomach which dilated enormously after pyloric obstruction. They considered the dehydration and chemical changes sufficient cause for the development of the picture of toxæmia and death. Hartmann and Smyth in 1926 showed that the chemical changes typical of experimental pyloric obstruction in animals were to be found not only in infants with congenital hypertrophic pyloric stenosis and in cases of high intestinal fistula but also *whenever* very marked vomiting occurred (provided there was no great decrease in the acidity of the gastric juice) as for example in urinary tract infections. They also felt that the picture of toxæmia seen in the presence of pyloric or high intestinal obstruction was due to the dehydration and alkalosis. Dragstedt and Ellis demonstrated that dehydration alkalosis and death followed total fistulous loss of gastric juice in dogs with isolated stomachs but with intestinal continuity. The present authors (3) were easily able to produce fairly marked alkalosis and hypochloræmia by repeated lavage in the intact dog.

That total loss of *pancreatic juice* (through pancreatic duct fistula) also was rapidly followed by toxæmia and death was demonstrated by one of us (R. E. (2)) and that the cause of such death was dehydration and acidosis was demonstrated both by Gamble and McIver (6) and the present authors. Total loss of bile (through a common duct fistula) was found by the authors¹ to lead to no marked chemical changes in the blood and to be compatible with life for long periods.

That partial loss of both gastric and intestinal secretions may be followed by a very variable picture (acidosis or alkalosis mild or severe) was particularly noted by one of us (A. T. H. (9, 10, 11)) in a study of clinical cases having as symptoms marked bilious vomiting or severe diarrhœa.

METHODS

All operations were carried out under ether anæsthesia. The bowel was severed between

L. P. B. Hedda

small crushing clamps either at the junction of the duodenum and jejunum or about 5 centimeters above the ileocecal valve. Each cut end was inverted with two successive purse string sutures and a bit of omentum was caught in the second tie. When a fistula was desired the proximal end was left open and sutured into the lower end of the incision. Unless especially noted water and food were allowed *ad libitum* and notes were kept as to the amount taken and the presence or absence of vomiting.

Blood for chemical analysis was secured by puncture of the femoral artery withdrawn under oil and the serum was obtained by centrifugalizing out the clot. The chemical methods used were the same as described in our previous communication (13).

Salt solution was given when noted intravenously into the leg vein or subcutaneously under the hind or fore legs. It contained in addition to salts 5 per cent glucose.

RESULTS OF HIGH INTESTINAL FISTULA AND OBSTRUCTION

The blood findings of 6 dogs with total fistula or obstruction at the distal duodenum are shown in Table I. If we consider first the results of *fistula* we note that in 4 animal deaths occurred in from 2 to 4 days after operation. No infection or cause other than the loss of gastro intestinal secretions could be found at autopsy to explain such early death. The chemical changes brought about by the loss of the digestive juices were similar in the 2 cases studied and consisted of the following: (1) extreme anhydremia as shown by the very marked increase in serum protein (to 10.8 per cent in dog B3 and 11.4 per cent in dog A15) and estimated reduction of serum water content (to 90.4 and 89.9 grams per 100 cubic centimeters respectively) as well as by the marked increase in clot volume (roughly 80 per cent in both instances). (2) reduction in chloride concentration which was moderate in dog B3 (503 milligrams per cent) and very marked in dog A15 (381 milligrams per cent). (3) reduction in carbon dioxide content (to 38.3 volumes per cent in dog B3 and to 48.5 volumes per cent in dog A15). (4) very marked increase in non protein nitrogen (to 160 milli

TABLE II—DATA FROM DOGS WITH LOW (HIOCEAL) INTESTINAL OBSTRUCTION (O) OF ILEUM (I)

| Dog (F) (O) | Days post op | | Time | Blood serum | | | | | | | | | | | Autopsy findings |
|----------------|-----------------|-------|-------------------------|-------------|------|------|-----|------|-----|------|-----------------|---------|-----|--|------------------|
| | Blood at | Death | | U | C | P | Ca | Na | K | Cl | CO ₂ | Glucose | NPV | | |
| Nrml | | | | 600 | 55 | 7 | 5 | 8 | 00 | 93.4 | 00 | 1 | | | |
| 5.4 (O) | 5.7 | 8 | Nrml | 456 | 69.9 | 20 | 6.6 | 4 | 0 | 0.5 | 1 | 67 | | | Distended |
| 7 (O) | 4.8 | 3 | Nrml | 567 | 55 | 6.55 | 4 | 17.8 | 4.5 | 0 | | 4 | | | Gravid |
| B.5 (O) | 4 | 0 | Nrml | 1 | 5.5 | 5 | | 70 | 3 | 0.7 | | 0 | | | Distended |
| 1.7 (O) | 6 | 6 | Nrml | 1.4 | 35 | 8.7 | 7 | 9 | | 80.5 | | 6 | | | Distended |
| A.9 (O) | 6 | 9 | Fond of water | 614 | 56.5 | 5.5 | 4.5 | 17.8 | 31 | 04 | 00 | 30 | | | Distended |
| (O) | 6 | 9 | Nrml | 474 | 7.3 | 5.4 | 5.5 | | 3 | 94.5 | | 5 | | | Obtunded |
| A. (O) | 5 | 5 | Nrml | 456 | 30 | 6.7 | 4.3 | 4 | 2 | 0 | | 35 | | | Distended |
| A.8 (O) | 6 | 7 | 500 mg glucose daily | 45 | 7 | 5.5 | 6 | 4.6 | 4 | 93 | 4 | 3 | | | Obtunded |
| B.5 (O) | 6 | | 500 mg glucose daily | 563 | 67 | 3.34 | | 6.5 | | 06 | | 5 | | | Distended |
| | | | | 479 | 66 | 3.40 | 3.5 | 44 | | 96 | | | | | |
| 3 (O) | 7 | 7 | 500 mg glucose daily | 10 | 5 | 4.95 | 9 | 3.5 | | 04.7 | | 55.5 | | | Obtunded |
| | 7 | | | 10 | 55.3 | 6 | 4.3 | 00.5 | | 04 | | 7 | | | Obtunded |
| 3.7 (O) | | 5 | Nrml | | | | | | | | | | | | Distended |
| 5.5 (O) | | 5 | PBS | | | | | | | | | | | | Distended |
| B.9 (O) | | 5 | Nrml | | | | | | | | | | | | Collapsed |
| A.5 (O) | | 5 | PBS | | | | | | | | | | | | Collapsed |
| A.4 (O) | | 4 | PBS | | | | | | | | | | | | Collapsed |
| 5.5 (O) | | | Nrml | | | | | | | | | | | | Collapsed |
| B.16 (F) | 7 | | Nrml | 5 | 7.8 | 4 | 6 | 49.7 | 35 | 93.7 | | 1 | | | |
| B.16 (I) | | 8 | | 56 | 44.6 | 5.75 | 9.6 | 5.5 | | 93 | | 30 | | | Negative |

H test 1 t t t t p y N Cl—4.7 mgs p t T tal base .39 mM

Estimated from p t t t

PBS—Phys. lg. lb fl. salt sol t .5 p e c t gl

interest that this finding occurred in dogs that died quite soon after the operation (Dogs B9, A5 and A4 3, 4 and 2 days respectively).

In only 6 of the 16 experiments was discoloration or gangrene found and in them it was most marked at the wall opposite the

mesentery. In 2 cases perforation through such necrotic areas had occurred. In 2 other cases gangrene of the terminal end of the ileum was found. It will be seen by consulting Table II in which these findings are mentioned that in these 6 dogs having more or less

former inelastic the eyeballs become sunken and the conjunctivæ injected and often are covered with a film of thick half dried pus. Asthenia becomes marked. When the tissues are cut at autopsy they seem dry and frequently the blood becomes so thick it scarcely runs from the cut aorta or vena cava. Infection was absent in all cases the peritoneum being clear and the wound dry.

If we consider next the results of obstruction we find almost the same trend of symptoms and the same clinical appearance and chemical changes leading also to early death. There are a few significant differences however. The animals vomit intensely and sometimes exhibit tetanoid movements. At autopsy there is always found dilatation of the duodenum and stomach above the obstruction. The carbon dioxide content increases rapidly from the beginning of obstruction and marked alkalosis may result (dogs B15 and 308). This alkalosis is presumably the cause of the tetany but why it should occur with obstruction more readily than with fistula is not so evident. Obviously relatively more gastric juice than pancreatic juice is lost from the body. It is possible thus in the presence of marked vomiting so much less gastric juice reaches the duodenum that stimulation of pancreatic secretion is considerably diminished. It is also possible that some reabsorption of pancreatic juice occurs in the duodenal segment or that distention of the latter interferes more with pancreatic than with gastric juice secretion. It is quite probable on the other hand that the acidosis in our dogs with duodenal fistula was due to the secondary changes in circulation and renal activity which allowed phosphoric and lactic acids to increase and had we examined the blood more immediately after the production of the fistula and before anhydramia and oliguria became marked we possibly would have noted an initial increase in carbon dioxide content.

RESULTS OF LOW OBSTRUCTION AND FISTULA

Sixteen dogs were subjected to simple complete obstruction just proximal to the ileocecal valve. All died spontaneously on the average in 6 days with extremes at 2 and 10 days. The clinical appearance following opera-

tion was different from that associated with high intestinal fistula or obstruction as described. Dehydration was minimal the eyeballs were not sunken and there was rarely marked dryness of the mucous membranes or conjunctivitis. The animals usually appeared quite normal for a number of days. Prostration however inevitably developed and often came on rapidly within a few hours and frequently was associated with the development of complete anesthesia. It was difficult to prognosticate accurately the duration of life death often being sudden and unexpected an experience which is frequently met with in clinical cases of low intestinal obstruction. Abdominal distention was moderate but increased day by day. As a rule vomiting was slight though in one dog (No 327) it was profuse. When the femoral vessels were exposed the artery was found contracted tightly whereas the vein was dilated and full. The pulse was feeble and so rapid as to be almost uncountable and the blood pressure could not be obtained with an intra arterial cannula. The picture in brief was one of profound shock.

At autopsy no dehydration of the blood or tissues was found as was true following high intestinal obstruction or fistula. The wounds were healed and the peritoneum was uninfected except in 2 dogs in which perforation of the obstructed bowel had occurred. The obstruction in each case was intact none showed any leakage and there was no reconstruction of the lumen.

Distention above the site of obstruction was found in every instance sometimes of the entire ileum but more often confined to its terminal third and in two instances involving only a segment of but 25 centimeters proximal to the occlusion. This distended bowel was filled with light brown liquid feces gas was present only rarely. The amount of this fluid varied but in the 3 dogs in which it was measured 300, 350 and 500 cubic centimeters were found. On chemical analysis it was found to be rich in base and chlorides (see Table II). In 3 dogs the bowel was lax and collapsed but its wall was stretched. Apparently by vomiting and regurgitation the distended loops had emptied themselves. It is of

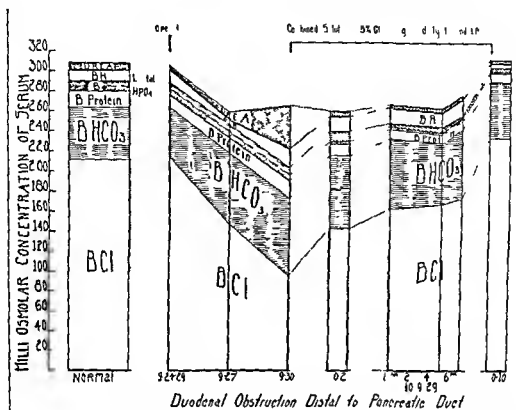


Chart 1. Showing chemical changes in the blood of dog 308 with return to normal following the administration of physiological buffer salts solution (combined solution). See text and Table I.

infant (9) and severe renal insufficiency (12) (2) a fatal outcome may be long delayed either by returning the gastro intestinal secretions to the intestine at a lower level where they can be re absorbed as shown by White and Fender or by balancing their loss by parenteral administration of the proper mixture of salts and water as illustrated particularly in the present experiments by dog 308.

During the first 6 days following the obstruction of the duodenum of this animal the blood developed the changes characteristic of duodenal obstruction to a very marked degree (Table I Chart 1). The sodium chloride content was but 269 milligrams per cent while the carbon dioxide content was 86.9 volumes per cent. Almost immediately after the administration intravenously of 500 cubic centimeters physiological buffer salts solution (plus 5 per cent added glucose) on September 3, 1929 the appearance of the animal improved the eyes regained luster and sufficient strength returned to enable the dog to stand and walk. With continued daily administration of 500 cubic centimeters of this solution

improvement continued. The effects on the chemical composition of the blood were quite marked after 2 days of treatment chloride increased from 269 to 410 milligrams per cent protein decreased from 7.44 to 5.15 per cent while non protein nitrogen dropped from 160 to 25 milligrams per cent and inorganic phosphorus from 7.0 to 3.0 milligrams per cent. With further treatment chloride continued to increase and the carbon dioxide content diminished steadily. On the eleventh day of treatment the chemical composition of the blood was practically normal with the exception of decreased protein (due to the prolonged starvation) and increased chloride. The increase of the latter was probably not abnormal since in many instances of low plasma protein seen clinically total base is maintained at a normal level through compensatory increase in chloride.

It should particularly be noted that although a mixture of salts was used which contained quickly available alkali the only time after the onset of treatment that the bicarbonate content of the blood increased was

necrosis of the bowel wall death was no more rapid nor was their clinical appearance in any wise different from the others. Microscopic study of the wall of the distended intestine in the 10 other cases where no gross gangrene was seen showed that viability was not seriously impaired and the mucous membrane though swollen and invaded with leucocytes was intact even just above the point of occlusion. The abdominal veins were engorged and the mesenteric lymph glands were enlarged and oedematous in all cases.

The liver usually appeared smaller than normal even though it was engorged with blood. In the gross areas of lobular necrosis could often be made out which on microscopic examination were seen to be periportal in distribution. Necrosis was manifest by vacuolization or fading of the cytoplasm and by disappearance or breaking up of the cell nuclei. In some cases there was a striking accumulation of long large bacilli around the portal venules. These microscopic observations were always made in animals autopsied within an hour after death thus the possibility of postmortem change being excluded. In dog 301 with a low intestinal fistula the autopsy showed only extreme emaciation.

The chemical studies of the blood are tabulated in Table II. In general there were encountered changes similar to but usually very much less marked than those associated with duodenal obstruction. In only 3 animals (Nos 324, 318 and 37) was there as much as 30 per cent reduction in serum chloride. In each of these 3 dogs dehydration and noteworthy non protein nitrogen retention was also present. One of these (No 324) showed alkalosis while in dog 327 there was moderate acidosis due apparently to accumulation of phosphoric and lactic acids. Vomiting was unusually profuse in the latter animal. Analysis of the intestinal fluid recovered from the dilated loops (Table II) showed that it might account for loss of considerable base even in absence of vomiting.

The behavior of lactic acid deserves special comment. Increase was observed in all but one animal and in a number of instances (dogs, B18, 327, A19, B15 and 321) the increase was marked. Still more significant is the fact

that in only 2 instances was there sufficient anhydremia (dogs B18 and 37) to explain the lactic acid increase on a basis of diminished circulation due to lowered blood volume. Circulatory failure without anhydremia undoubtedly existed in these cases however and probably together with diminished hepatic function accounted for the accumulation of lactic acid. We cannot however completely exclude glycolysis of blood sugar *in vitro* with production of lactic acid as a factor in this increase. All we can say is that no more delay occurred in the chemical handling of the blood samples in this group of dogs than in the group with high intestinal obstruction or fistula. We cannot either be certain that increased muscular activity in the form of shivering did not play a significant part by increasing acid production. In this connection it is interesting to note that in the similar case of ileocaecal fistula studied on both the seventh and eleventh days after operation lactic acid concentrations of approximately 50 milligrams per cent were encountered. On the first of these days there was evidence of base and chloride loss without circulatory or renal insufficiency on the second anhydremia with phosphate and non protein nitrogen retention was present.

In all but one animal (dog 37 the most dehydrated in the group and which vomited profusely) serum protein values were below the normal. The dog which lived the longest after operation (B13) showed the lowest value. Starvation is probably the chief factor contributing toward the diminution of protein but again hepatic insufficiency or some other unknown factor may also play a part.

DEDUCTIONS

If we accept as an established fact that marked dehydration and chemical changes such as acidosis or alkalosis may in themselves be fatal it becomes very probable that the dehydration and the chemical changes are the principal causes of death after duodenal obstruction or fistula because (1) the changes observed are extreme and of the same general type and degree as those seen associated with fatal cases of gastric or pancreatic duct fistulae (13), pyloric (11) obstruction, cholera

necessarily due moreover to gangrene or necrosis of the obstructed intestine

3 Blood chemical examination cannot be relied upon as a measure diagnostic either of the site or presence of intestinal obstruction. Its chief value is that it enables one to determine the extent of loss of gastro intestinal secretions and the adequacy of treatment designed to restore such loss

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during the period of a few hours immediately after the injection. This increase was slight and affected but little the otherwise steady diminution to normal.

The death of this animal 16 days after the duodenal occlusion seemed referable chiefly to starvation and anæmia, the latter produced in part by the taking of considerable blood (approximately 200 cubic centimeters in all) for the chemical examinations.

Concerning the *cause of death* which follows *low intestinal obstruction* we may say from the present findings that the chemical changes in water and electrolyte balance of the blood do not seem sufficient to account for the fatal termination. With but the very few exceptions already noted, the changes encountered at or near death of the dogs with low obstruction were slight and were probably due to (1) some loss of fluid by vomiting and (2) accumulation of fluid in the dilated loops even though not vomited. Thus in dog A19 which did not vomit the blood was quite normal. More over these changes occurred also in dog B361 which lived for 18 days after the production of an ileocecal fistula.

The development of a characteristic fatal outcome in over half of our experiments with out gangrene or even demonstrable lesions of the obstructed wall or mucous membrane seems to disprove the idea of many that damage to the involved intestine is a necessary part of its pathogenesis. While changes in permeability of the obstructed bowel may occur and be important, gross or microscopic necrosis is apparently not essential. That something abnormal is being absorbed through the portal vein is indicated by our finding of perportal necrosis and that bacteria may pass through the wall is borne out by their presence in the liver in some of our dogs. Death from the evidence already mentioned seems due to a profound peripheral circulatory failure or shock, which is quite distinct from the circulatory impairment due to dehydration in the case of high obstruction as described above.

Concerning the value of blood chemical examination in the *diagnosis* of the site or even the presence or absence of obstruction, it seems to us that the data presented in this

paper and preceding ones show clearly that chemical changes are due to loss of gastro intestinal secretions and that on the one hand very marked changes may be encountered in the absence of obstruction or in its presence at any level and on the other hand there may be no changes associated with low intestinal obstruction. Blood chemical examination however helps very much in determining the adequacy of *treatment* of high intestinal obstruction or fistula, and of low intestinal fistula, but may be misleading in cases of low intestinal obstruction where death may occur at any time and often most unexpectedly.

From the practical point of view, while the present findings emphasize again the necessity of parenteral fluids in cases of high obstruction with dehydration, they point out their relative inadequacy where low obstruction exists. To be sure such fluid restores losses due to vomiting which has nearly always occurred to some degree in such cases. By adding to the blood volume moreover it combats circulatory failure. These beneficial effects are however usually slight and in severe cases too often prove insufficient to prevent a lethal outcome even with appropriate surgical relief of the obstruction.

SUMMARY AND CONCLUSIONS

In an attempt to evaluate the blood chemical change as a factor in causing death in high and low intestinal obstruction, complete fistula or obstruction was created in 6 dogs at the terminal duodenum and in 17 at the ileocecal junction. Changes in blood serum concentration of chloride, carbon dioxide content, protein, inorganic phosphate, lactic acid, total base, water content and non protein nitrogen were followed and the following conclusions were drawn:

1. The principal cause of the rapid death which follows high obstruction (or fistula) in the terminal duodenum is to be found in the chemical changes in the body fluids, resulting primarily from loss of gastro intestinal secretions and secondarily from circulatory and renal insufficiency due to dehydration.

2. The cause of death following low (ileocecal) intestinal obstruction is not except in rare instances due to such changes. It is not

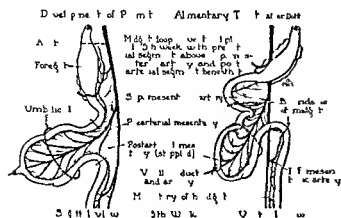


Fig. 1 Semidiagrammatic illustration of the disposition of the alimentary tract in the embryo at the fifth week of intra uterine life.

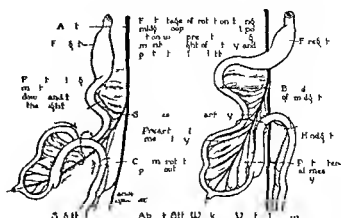


Fig. 2 Semidiagrammatic illustration of the disposition of the alimentary tract in the embryo at the 11th week of intra uterine life.

and the latter is forced into the root of the cord as a temporary developmental umbilical hernia. The hindgut is retained in the abdomen possibly by the retention band pointed out by Frazier and Robbins (1915) which does not keep pace with the growth of the intestine or mesentery.

The first stage of rotation is normally completed between the fifth and tenth weeks of intra uterine life while the midgut loop lies in the umbilical cord. The details are illustrated in the diagrams. The intestine increases rapidly in length so that there results an S shaped flexure, the pre arterial segment forming the right and the postarterial the left half (Figs 1 and 2). According to Dott failure of rotation up to this stage occurs only in connection with extroversion of the cloaca. The term 'non rotation' refers to an abnormality in the development of the second stage.

The second stage is completed by the tenth to the eleventh week as the midgut loop is returned to the abdominal cavity and the caecum reaches the right loin. Frazier and Robbins explain the return of the contents of the cord to the abdominal cavity by the relatively decreased rate of growth of the liver which makes room for the midgut in the abdomen. Normally due to the overgrowth of the pre arterial segment the proximal coils of the small intestine are reduced first behind the superior mesenteric artery while the caecum returns last (Figs 3A and 4A). As a result there occurs a 270 degree counter

clockwise rotation about the axis of the artery which places the duodenum behind and the transverse colon in front of the mesenteric vessels. This reduction forces the descending colon to the left.

The third stage is concerned with fixation and fusion of the various portions of the intestine in their adult position—and the number of cases of anomaly in this group are necessarily large.

Dott outlines the derangements of rotation in these three stages as follows: (1) Failure of rotation in the first stage occurs only in the rare condition of extroversion of the cloaca. (2) The derangements in the second stage are of three types (a) non rotation of the midgut loop in which the small intestine lies to the right of the midline and to the right of the superior mesenteric artery with the colon on the left side (b) reversed rotation of the midgut loop in which a 90 degree clockwise rotation occurs instead of the normal 270 degree counter clockwise movement so that the duodenum and superior mesenteric artery are anterior to the transverse colon (c) malrotation of the midgut loop which includes various irregular defects in rotation. The sequence of visceral return determines their final disposition. (3) Derangements in the third stage of rotation are composed of cases of early fixation of the caecum failure of elongation of the colon deficient fixation or excessive elongation of the colon and deficient fixation of the postarterial mesentery forming a mobile caecum or a floating ileocolic segment which

ANOMALIES OF INTESTINAL ROTATION

A REVIEW OF THE LITERATURE WITH REPORT OF TWO CASES¹

H E HAYMOND M D AND LESTER R DRAGSTEDT M D PH D CHICAGO

F m th D p tm f S gery f th U y f Ch g

ABNORMALITIES in the disposition of the abdominal viscera are doubtless of considerable interest to the student of embryology but they are of great practical importance to the surgeon. During the course of an abdominal operation the surgeon may find himself quite unexpectedly presented with a most perplexing surgical problem. These instances occur most commonly in infants or children but may be found in adults in association with other pathology or as the proximal cause of disease. The present report concerns two cases of unusual types of congenital anomalies in the development of the intestines met with during the past year and a survey of the literature. In both cases an attempt is made to outline the specific developmental defect responsible for the final position of the intestines.

Early descriptions of anomalies of intestinal rotation in the human embryo were made by Reid (1836) Simpson (1839) and Cheine (1868). In 1923 Dott reported 3 cases of anomalies in the second stage of rotation and collected a total of 48 from a review of the literature. Hecker Gruenwald and Kuehlmann (1926) collected 27 cases of congenital anomalies of form and position of the large intestine in addition to their own 2 cases. A careful survey of each of these cases reveals that 12 of the 29 (excluding those reported by Dott) can be accurately classed as derangements in the second stage of rotation as the condition was confirmed at autopsy or operation. These cases in addition to Dott's collection are Gruber (2 cases) Groenroos Tandler (3 cases) Sencert Strehl Lemesc and Kolsko Kiffer and Hecker Gruenwald and Kuehlmann (2 cases) Ostroumow and Brewer (1928) reported another case and collected from the German literature the cases of Hausmann Hammesfahr and Richelmann as well as the reports of Rostowzew Goljajew and Kortschitz from the Russian literature.

Additional cases have been reported by Rainer (3 cases 1907) Sauerbeck (2 cases 1909) Sawin (2 cases 1909) Smith (5 cases 1911) Pan (1920) Gutierrez (1923) Bulman (19 4) Walker (1926) Harvey (1926) Woolsey (2 cases 19 7) Donald (1927) Waugh (3 cases 1927) Thomson (1928) Grant (2 cases 1928 and 1930) Lee (19 9) Edington (1929) Mole (1930) Peigneaux and Fruchaud (1930) Davis (1930) and Brouet and Caroll (1930) Gilhert (1925) and Vasselle (1926) each reported a case with very suggestive roentgenologic findings but neither case was explored. However despite the conclusive X ray evidence of this type of anomaly they probably should not be included in the present series. Altschul (1929) refers to left sided position of large bowel in two unexplored cases which are not included in the authors series.

Much of our knowledge of the position and rotation of the intestines in the embryo dates from the classic work of Mall in 1898. He demonstrated that the rotation of the midgut was due to the growth of the small intestine with descent of the viscera and not to a shoving of the large intestine over the small as shown in the Hertwig diagrams. At the end of the fifth week of intra uterine life the alimentary canal may be divided into three portions—the foregut midgut and hindgut dependent upon their form and their blood supply which comes from the coeliac axis the superior and inferior mesenteric arteries respectively. For purposes of description the midgut is divided into a pre arterial and a postarterial segment by the superior mesenteric artery. In the adult all that portion of the alimentary tract from the ampulla of Vater to the left third of the transverse colon is derived from the midgut. It is in this portion of the intestine that errors in development are most frequent.

The early rapid growth of the liver and the midgut soon fills the intra abdominal space

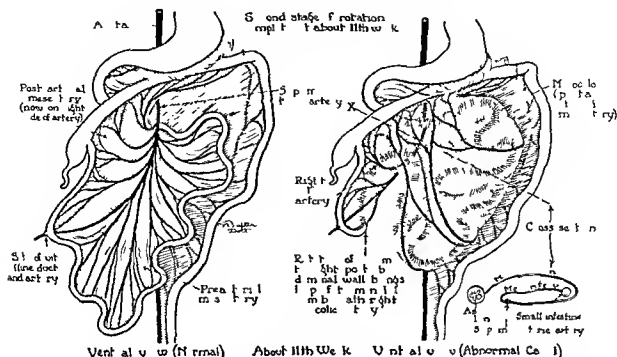


Fig. 4. Diagrams representing the normal conditions in the embryo at the eleventh week or at the completion of the second stage and the proposed conditions present at about the eleventh week in Case 1.

exploratory laparotomy. Fluids were forced the following day. Blood examination after transfusion was haemoglobin 65 per cent, red blood cells 4,800,000 and white blood cells 9,700. The morning of operation a large amount of fluid containing food particles was aspirated by stomach tube.

Operation. On February 4, 1930 an exploratory laparotomy was performed by one of us (L.R.D.) under ethylene and oxygen anaesthesia. The abdomen was opened through a right rectus incision. The stomach was explored and a large carcinoma was found involving the entire pyloric antrum. Regional metastases were found in all neighboring lymph glands and several nodules were found in the liver. Due apparently to an anomaly of rotation all of the small intestines were found behind a glistening membrane. The duodenojejunal fossa was closed. The entire colon occupied approximately its normal position. Due to this anomaly a gastroenterostomy was not done.

The postoperative course was uneventful except for a few paranoid delusions on the first day after operation. He was discharged from the hospital and readmitted on several occasions. His clinical picture was that of progressive failure and increasing anaemia until death on November 4, 1930. During his last stay in the hospital there was only an occasional spell of vomiting.

Necropsy was done November 4, 1930 by Dr. Paul Cannon and showed the following points of interest. The body weighed 51.9 kilograms (114 pounds). There was moderate oedema of the lower extremities.

Abdominal cavity. The fat in the midline of the anterior abdominal wall was approximately 3 mill-

imeters thick. It was golden yellow in color. There were 200 cubic centimeters of clear straw-colored fluid in the abdominal cavity. The fat of the omentum was rather gelatinous in appearance. The small intestine was almost entirely beneath a layer of peritoneum. The transverse colon was anterior to this mass. The great omentum lay in the greater peritoneal cavity. There were fibrous adhesions between the parietal peritoneum and the former laparotomy incision. The anterior margin of the liver extended 3 centimeters below the costal margin in the midclavicular line. The margin was rounded. The surface contained numerous whitish nodules from 2 millimeters to centimeters in diameter. There were adhesions between the capsule of the liver and the anterior abdominal wall. The cæcum was in its normal position and was outside the peritoneal sac. The appendix was normal except that it was embedded in fibrous adhesions in the pelvis. The lower 9 centimeters of the ileum were also outside the peritoneal sac and entered the cæcum on the left side. The medial surface of the cæcum was adherent to this peritoneal sac by fibrous adhesions. The cæcum, ascending transverse and descending colons seemed to be in normal relationship outside the peritoneal sac. All of the small intestine from the duodenojejunal junction to the last 9 centimeters of ileum were within this peritoneal sac. The mesenteric lymph nodes were normal. The duodenojejunal flexure extended centimeters to the right of the midline and the superior mesenteric artery and the root of the mesentery passed posteriorly to the duodenum, actually passing behind the first part of the jejunum. The duodenum was adherent to the anterior wall of the

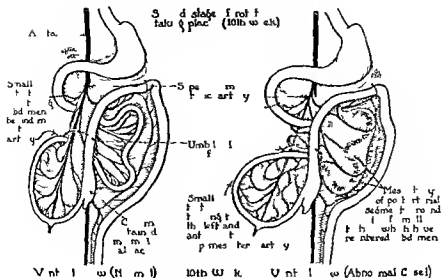


Fig 3 Diagram of the normal condition in the embryo. The left diagram shows the normal condition in the embryo. The right diagram shows the abnormal condition in the embryo. The labels are: Stomach, Duodenum, Jejunum, Ileum, Cecum, Appendix, Arteries, Veins, and various other organs and structures.

has been found in the neighborhood of the spleen.

The cases to be reported here concern abnormalities of the midgut which can be logically explained by derangement of rotation of the intestines in the second stage (Case 1) and by fixation after excessive rotation with chronic volvulus of a mobile postarterial segment (Case 2).

CASE 1. Carcinoma of the stomach congenital malrotation of the midgut. Exploratory laparotomy. Necropsy. W. J. (A. M. B. H. 19603) aged 67 years a retired hardware dealer was admitted to the Albert Merritt Billings Hospital February 10, 1930 with a complaint of debility of years duration abdominal distress anemia and dizziness of 6 months duration and loss of appetite for months. He considered himself in good health for 15 years prior to the onset of his present illness. He gave no history of nausea or vomiting. There had been an estimated loss of weight of 5 to 10 pounds. He had had two or three rather loose stools daily but no tarry stools or gross blood had been noted. The past medical history was irrelevant. The family history revealed nothing of significance.

The patient was a very poorly nourished pale cachectic white male 67 years of age. Height was 53.4 kilogram (117.5 pounds). The general physical examination was essentially negative except that the skin conjunctiva mucous membranes and finger tips showed a marked degree of anemia and the general muscular tone was only fair. There was a somewhat rounded fullness in the epigastrium. No peristaltic waves were noted. There was no

rigidity or tenderness of the epigastrium. Despite epigastric resistance a small lemon sized mass could be palpated to the right and cephalad to the umbilicus. There were no nodules in the region of the umbilicus and the liver or its margin could not be felt. Blood pressure was 126-7.

On February 17, 1930 the hemoglobin was 52 per cent the red blood cells 3,970,000 the white blood cells 10,400. The differential blood count showed polymorphonuclears (neutrophils) 71 per cent large lymphocytes 5 per cent small lymphocytes 16 per cent mononuclears 5 per cent eosinophiles 3 per cent and basophiles none. The urine was normal and the blood Wassermann reaction and Kahn tests were negative. An end meal aspirated at the end of 50 minutes had a volume of 550 cubic centimeters with 4 clinical units of free hydrochloric acid and 33 of total acid. A trace of lactic acid was found. The benzidine reaction was negative. The aspiration contained particles of undigested food such as vegetables and fruit. After admission to the hospital the patient vomited some undigested food and brownish material. This contained occult blood shown by a 3+ positive benzidine reaction. Fluoroscopic examination was done by Dr. Paul C. Hodges of the University of Chicago Clinics who reported a large neoplasm involving the pyloric end of the stomach particularly at the greater curvature producing gross obstruction. Stool examination repeatedly showed strong benzidine reaction on a practically meat free diet.

Pre-operative course. After the X-ray examination the patient had considerable abdominal distress particularly in the morning. He became nauseated frequently and vomited on several occasions. The patient was given 500 cubic centimeters of citrated blood on February 22, 1930 in preparation for an

duodenojejunal fossa. The sac in this case was undoubtedly formed from the mesentery of that part of the embryonic gut which later became the ascending colon. The variations from normal development which could produce this type of abnormality are indicated in the diagrams (Figs 5A and B, 3B and 4B). It is probable that during the second stage of rotation a relative overgrowth of the postarterial segment occurred. In the return of the viscera to the abdomen from the umbilical cord for some reason the proximal coils of the midgut passed anterior to the superior mesenteric artery (Fig 3B) instead of posterior (Fig 3A) which is the usual case. In their progress the loops of midgut pushed the mesentery of the postarterial segment (later to become the mesentery of the ascending colon) in front of them forming a hernial sac which in the adult contained almost the entire small intestine. Such an explanation accounts satisfactorily for the sac and its contents, the retroduodenal position of the superior mesenteric artery and the limits of the peritoneal reflections. The small loop of ileum in the general peritoneal cavity may represent that portion of the midgut which did not enter the sac at the time of rotation of the more proximal loops. The fixation of the cæcum may have occurred at any time after the eleventh week of fetal life.

It must be emphasized that in this type of anomaly the relation of the superior mesenteric artery to the duodenum and to the sac and the relation of the dextrocolic artery to the terminal ileum are of fundamental importance in determining the mechanism of the abnormality.

An almost identical case in an adult male (dissection case) has been reported by Liddle and Cameron in which death was unassociated with the intestinal anomaly. Andrews and Sumner's clinical cases and Fleming's dissection case were somewhat similar but the relation of the superior mesenteric artery was not described. Andrews explains duodenal hernia on the basis of a congenital anomaly in the development of the peritoneum due to imprisonment of the small intestine beneath the mesentery of the developing colon. Even though his views have not found general



FIG. 6 Case. Photograph taken at autopsy showing the disposition of the small intestines in the intra-abdominal sac.

acceptance in the literature his theory of the mechanism of the hernial formation is similar to the proposed course of development in this case.

CASE 2. Congenital malrotation of intestines operation recovered. C. F. (A.M.B.H. 15256) aged 16 student was first seen in the out-patient department of the University of Chicago Clinics September 11, 1929 with a complaint of distress in the epigastrium and intermittent vomiting since birth. The patient had never been in good health. His birth was normal. He was a breast and bottle fed baby. Two days after birth vomiting began and about 2 weeks later he was extremely jaundiced for a few weeks. Vomiting had continued intermittently up to the time of admission. At no time since birth had he been entirely free from vomiting spells. The attacks varied in frequency, they might appear as often as once a week or more and again they might be as infrequent as a month or more. He was certain that large meals caused gastric distress and that large food intake might cause vomiting. There was no other relation to food intake, no relation to time of day, character of food intake or excitement. The vomiting was of a projectile nature and was usually large in amount. The vomitus was thick and greenish yellow. He was unaware of any factor that would precipitate an attack. There was borborygmi with pain in the epigastrium with the vomiting and the pain preceded the rumbling as a rule. He obtained relief of the gastric distress by

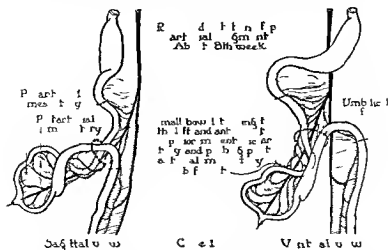


Fig 5 Dia ms ll st ting the p po d c d to s p e n t at th
ber n f th m l t t n f the co d st ge t th c h th week in
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ac by fibrous adhesions which could be separated. It then extended within the peritoneal cavity to the pylorus. The duodenum measured 4 centimeters in length. In the lower margin of this sac was a fossa 3 by 1 centimeter through which the ileum left the sac to enter the cæcum. Careful dissection of the sac revealed that the transverse colon and its mesocolon could be easily dissected from the sac on the left side. On the right side the sac became intimately associated with the transverse mesocolon a few centimeters to the left of the entrance of the jejunum into it. The blood supply of the transverse colon did not come through vessels in the wall of the sac but along the mesenteric border of the ascending colon. The medial aspect of the ascending colon could be dissected free from the peritoneal sac until the mesenteric border of the ascending colon was reached. Here the layers were fused and could not be separated. The duodenal artery, a branch of the superior mesenteric artery, passed down to the cæcum in the posterior wall of the sac. This vessel was somewhat larger than normal. After the peritoneal sac had been freed on the left side the hand could be passed between the posterior abdominal wall and the posterior wall of the sac to the base of the short mesentery and almost to the mesenteric border of the ascending colon.

Liver and gall bladder. The liver weighed 560 grams. The hepatic tissue was largely replaced by neoplastic tissue in which there were many areas of yellow necrosis.

Gastrointestinal tract. The wall of the stomach was essentially normal in the fundus and cardia but at the pylorus there was a dense growth of firm neoplastic tissue which encircled the pylorus so that one finger could be passed through it with some difficulty. The neoplastic area had a circumference of 9 centimeters and stopped abruptly at the pyloric sphincter.

Pancreas. The pancreas was of normal size and was adherent to the stomach wall throughout its entire extent by fibrous adhesions. The tissue itself was pale and there were neoplastic growths within it. The head of the pancreas lay in its usual relation to the curvature of the duodenum. On section the tissue was pale but there were no other abnormalities to be noted.

A very careful dissection was made and the points of interest either photographed immediately or sketched by the attending artist, Miss Gladys McHugh. The appearance of the peritoneal pouch and its contained small intestines is best appreciated by examination of the photograph (Fig 6) taken at the autopsy and the drawings in Figures 7 and 8. As noted in the autopsy report the peritoneal pouch contained the lower portion of the duodenum, the entire jejunum, and all save the distal 9 centimeters of the ileum. The duodenum and first part of the jejunum passed transversely in front of or anterior to the superior mesenteric artery—a point of great significance in determining the essential nature of anomalies in intestinal rotation. The fact that the upper and lower ends of the small intestine entered and left the sac at widely different places together with the fact that a layer of the posterior parietal peritoneum could be demonstrated distinct from the posterior layer of the sac preclude the possibility that we could be dealing with a very large retroperitoneal hernia. Treitz hernia or hernia into the

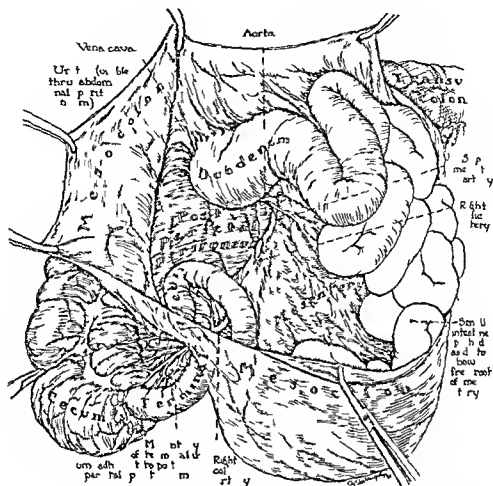


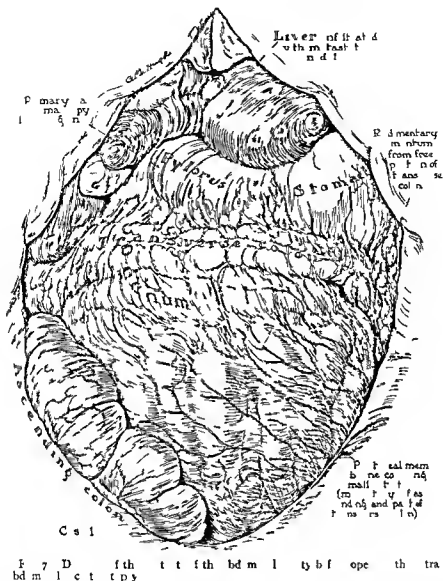
Fig 8 Drawing of the contents of the intra abdominal sac at autopsy showing the relation of the duodenum to the superior mesenteric artery and the terminal ileum to the dextrocolic artery

superior coloboma divergent squint and corneal scar due to an old injury. The teeth showed extreme dental caries. The abdomen was of normal contour. There were no peristaltic waves or patterns. There were no masses, solid organs, tenderness or rigidity palpable. The remainder of the physical examination was negative.

Fluoroscopic examination was done September 13, 1929. The stomach and duodenal bulb were normal. There was marked dilatation of the duodenum with reverse peristalsis. No barium was seen passing into the jejunum. At the end of 3 hours about a third of the barium had remained in the stomach. The entire duodenum from just distal to the bulb to apparently the duodenojejunal junction was filled and dilated to three or four times its normal size (Figs 9A and 9B). Barium was given by mouth at this time to connect the stomach definitely with the mass of barium in the upper right quadrant which proved to be duodenum. An impression was made of partial obstruction at the duodenojejunal junction probably caused by pressure from the mesenteric vessels or fold. An examination of the blood at the time of the first admission revealed hemoglobin 12.6 grams (Newcomer), red blood cells 4,850,000, white blood

cells 8,000, hematocrit 41, volume per cent of cells specific gravity 1.058, hydrogen ion concentration of the plasma 7.6, calcium 9.2 and phosphates 4.0. The urine was normal. The blood Wassermann reaction and the Kahn test were negative. The blood non protein nitrogen ranged from 25.9 to 31.3, urea nitrogen 14.6, carbon dioxide capacity 58.4 cubic centimeters to 72.4 cubic centimeters and chlorides from 245.6 (sodium chloride 407.7) to 281.5 (sodium chloride 465.3) milligrams. An Ewald meal revealed free hydrochloric acid 40 and total acidity 58 clinical units. Stool examination and fluoroscopic barium enema were not done.

The laboratory findings on the second admission were as follows: hemoglobin 75 per cent, red blood cells 4,820,000 and white blood cells 7,300. The urine was normal. The hydrogen ion concentration of the plasma was 7.51 and the carbon dioxide capacity was 59.6. The blood non protein nitrogen ranged from 31.7 to 34.4, urea nitrogen 12.0 to 13.5, calcium 10.5 to 11.1 and phosphates 3.28 to 4.54. The blood chlorides were 231.2 (sodium chloride 381.1), 256.0 (sodium chloride 424.0), 212.0 (sodium chloride 450.7) and 72.0 (sodium chloride 450.7) on November 5, 6, 25 and 29 respectively. The



emptying the stomach. The e had been no change in the character of the attacks since they first began. His appetite was fair and height had increased from 50 to 60 pounds during the past year. There was no gastric distress, jaundice, or hæmorrhage. No palpitation or hæmorrhoids other than that stated in the present illness.

The present medical history is negative and the family history was irrelevant.

The patient was admitted to the Albright Memorial Hospital September 30, 1909, for further observation. During the time of his first hospital stay there were no vomiting attacks and he remained free of epigastric distress despite a regular diet. He was discharged October 7, 1909, with instructions to be examined immediately when another attack developed. The patient returned well

until the morning of November 5, 1909, when he was awakened by mild abdominal pain in the region of the umbilicus. This pain remained constant and although he became slightly nauseated, he was unable to vomit. He did not at breakfast but drank about one glass of water and two glasses of chocolate malted milk. At 3:30 p.m. he had two attacks of projectile vomiting. The emesis measured 2,000 cubic centimeters; it was bile stained, watery, and contained finely divided particles of food. After the attack the pain diminished a great deal. He was readmitted to the hospital and blood chemistry determinations made.

The patient was a fairly well developed, poorly nourished white male of 16 who appeared several years under his stated age. He weighed 47 kilograms (103.6 pounds). The left eye showed medial

The patient was called back to the clinic November 19, 1930 for further study. Since leaving the hospital he had been perfectly well and had had no suggestion of the slightest gastric complaint. He weighed 47.1 kilograms (103.6 pounds) on admission and when seen in the clinic weighed 54.1 kilograms (119 pounds). He was much stronger than he had ever been and was working daily. His general appearance had changed from that of a sickly, undernourished, poorly developed boy to that of a healthy, growing adolescent youth. A fluoroscopic examination was done at the time of the clinic visit. The stomach was normal except for angularity of the greater curvature of the pars media—almost certainly due to adhesions. The bulb was about normal as to size but a little angular in shape. The second portion was not dilated; however, it extended directly to the right and did not pass behind the stomach. Five minutes later considerable barium had passed into the jejunum, and all of the small intestine visualized lay to the right of the spine. A barium enema revealed that the colon filled promptly and completely. There was some redundancy of the transverse colon. The ascending colon and cæcum were on the right side and were in normal position except for being a little high (Fig. 10).



FIG. 10. Photograph of roentgen plate taken approximately 1 year after operation. Barium enema. Ascending colon in about normal position except the cæcum is still a little high. Case 2.

This case can be explained best as an anomaly of rotation in the third stage. The details are indicated in the diagrams in Figure 11. There was undoubtedly at one time a floating ileocolic segment due to deficient fixation of the postarterial mesentery. In some manner the cæcum rotated under the short mesenteric pedicle and became fixed in the left upper quadrant, thus producing chronic obstruction of the jejunum and ileum.

The secondary volvulus of the remaining portion of the small intestine can be easily accounted for by its excessive mobility. It is remarkable that such a patient could have survived for 16 years with the arrangement of

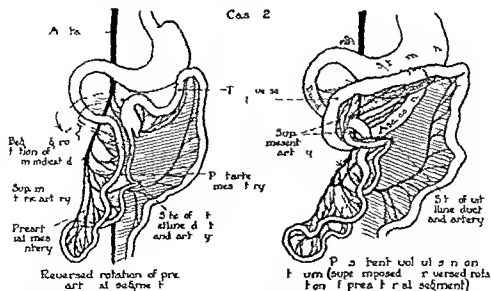


FIG. 11. Diagrams representing a possible stage in the development in Case 2 and the position of the midgut as found at operation in Case 2.



Fig 9. Photographs of the patient taken before operation showing the dilated stomach. The grossly dilated distal portion of the duodenum of an undetermined nature. A duodenal jejunal anastomosis was advised.

chloride content of the vomitus 3.4425 milligrams per 100 cubic centimeters (sodium chloride 739.7). A second X-ray examination revealed the same findings as before—a mechanical obstruction of the distal portion of the duodenum of an undetermined nature. A duodenal jejunal anastomosis was advised.

Operation. On December 5, 1939, an exploratory laparotomy was performed by one of us (L.R.D.) under ether anesthesia. Operative report: A long right rectus incision was made displacing the rectus muscle outward. The abdomen was opened. The stomach, as soon as it was dilated but otherwise normal. The duodenum was considerably dilated throughout its entire extent. The transverse colon was apparently normal. There were numerous very large veins and arteries on the ascending colon and cecum arranged along the mesenteric bed. The ileum about 8 inches from the cecum attached firmly to the duodenal junction by a peritoneal fold and fibrous adhesions. There were also very large dilated veins in this region. The lower end of the ileum was surrounded by the root of the mesentery of the small intestine in such a way as to produce partial obstruction to the lower portion of the duodenum and to the lower end of the ileum. The first part of the jejunum was seen markedly dilated and its wall was hypertrophied. The dilatation and hypertrophy gradually became normal as the ileum was approached. The ileum was very much

smaller than normal, cyanotic in color and appeared to have suffered from chronic circulatory disturbance. The entire small intestine was rotated clockwise on the root of the mesentery for about 120 degrees and the intestines themselves were wound around the root of the mesentery. When the transverse colon was lifted up the first part of the jejunum was found but it extended downward into the duodenojejunal fossa and out of this fossa could be seen coming the lower end of the ileum. The entire length of the small intestine from the first part of the jejunum as pulled out through this false fossa. As the loops of bowel were pulled out it was discovered that they were not lying in a retroperitoneal sac but in the general peritoneal cavity and the fossa was made up of the root of the mesentery which formed a bridge. The duodenojejunal junction was liberated from its peritoneal fold and adhesions and the cecum and appendix were brought down from the upper left quadrant and fixed to the lower right quadrant of the abdomen. The intestines then were replaced and the abdomen closed.

Following operation the patient was given Ringer's solution intravenously on one occasion. His postoperative course was very smooth and entirely uneventful. He was discharged on the sixth day after operation. He had had no gastric distress of any degree up to that time.

ciates has been at great pains to outline the important pathogenic factors in intestinal obstruction at different levels of the intestine on the basis of present information. Two factors appear to be of paramount importance: first, a toxemia due to the absorption of various toxic fractions from the obstructed intestine made possible by an injury to the protecting mucosa as a result of increased intraintestinal pressure; and second, severe tissue dehydration with hypochloremia and usually alkalosis due to failure of reabsorption of gastric and pancreatic juice. It is very probable that the second factor is of chief significance in the production of the symptoms displayed by this patient. On one occasion he vomited 2,000 cubic centimeters of fluid containing a total of 8.84 grams of chloride (sodium chloride 14.79). Inasmuch as five or six attacks of vomiting with equivalent loss of gastric content were the rule during a three day period of sickness, the hypochloremia and dehydration are readily accounted for. The alkalosis indicates a relatively larger loss of the acid gastric juice than pancreatic juice with its high content of fixed base.

CASES FROM THE LITERATURE

An analysis of Dott's cases shows that 35 of the 48 were discovered accidentally. Thirteen presented symptoms relevant to the anomaly. The sex incidence was about three males to one female. The age ranged from within a few days of birth to old age with the greatest frequency seen in the first few days of life.

In the 33 additional cases collected by the present authors 18 gave a history of gastric distress due to the anomaly. No mention was made of abdominal discomfort in 9 instances. The two so-called unconfirmed cases of Gilbert and Vasselle gave histories of gastric and abdominal distress. The case reported by Pinkerton is not included in the authors' series because it is difficult to decide whether his patient had an anomaly of rotation in the second stage with a volvulus after a 90 degree reversed rotation or a 450 degree clockwise volvulus of a free ileocolic segment due to derangement of fixation in the third stage. The references of Serck-Hansson (1926)

Dillenseger (1909) and Darbois and Sobel (1929) which might contain cases of derangement of rotation in the second stage were not available to the authors. The sex incidence was 14 males, 16 females and 3 with sex not given. The age groups were: under 10, 11 cases; 10 to 20, 3 cases; 20 to 30, 6 cases; 30 to 40, 4 cases; 40 upward, 4 cases; 1 case classified as a child and 4 as adults. Thus 64 per cent of the additional cases were under 30 years of age. Dott collected but one other case of reversed rotation in the second stage in addition to his own. Hausmann and Strehl each added a single case to the literature. Serck-Hansson's reference may be a report of a similar condition. The present series of collected reports include 5 cases of the same type bringing the total to 9—all of which had symptoms of obstruction, were operated upon and died with the single exception of the case reported by Peigneaux and Truchaud.

SUMMARY

1. Two cases of anomaly of intestinal rotation are reported.
2. One case which formerly would probably have been considered an intra-abdominal hernia is now more logically explained on the basis of malrotation of the midgut loop in the second stage of rotation.
3. A case of chronic volvulus neonatorum is described.
4. Thirty-three additional cases (including the authors' Case 1) are collected from the literature bringing the total number of cases of anomaly in the second stage of rotation to 100.

The authors wish to express their great appreciation to Miss Gladys McHugh for the painstaking and accurate drawings in this paper.

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ANALYSIS OF ADDITIONAL CASES OF ANOMALY OF INTESTINAL ROTATION
IN THE SECOND STAGE

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the various portions of the midgut as found at operation. This case is quite similar to the cases of volvulus neonatorum reported by Dott and Charsley and Richardson except

that this patient survived 16 years before coming to operation.

In a detailed study reported recently one of the authors (L R D) with various asso

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THE EFFECT OF ANÆSTHESIA UPON THE BLOOD SUGAR CONTENT

EXPERIMENTAL INVESTIGATION

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 F m th Depa tm ts IS g ry d Clin IS g ry Ed b g h Uni ty Sc tl d

THE treatment of patients suffering from the postoperative effects of anæsthesia and shock is an every day problem in surgical work, and one of the commonest routine practices is the administration either rectally or subcutaneously of an isotonic saline with the addition of glucose

The biochemical basis for this procedure has hitherto been assumed rather than proved although within recent years several papers have been published dealing with the problem

The earliest note on the subject was made by Thannhauser who inferred from the not infrequent appearance of glycosuria in post traumatic shock that there must be an increase in the level of the blood sugar Cannon (5) confirmed this inference by direct observation, but neither of these writers dealt with the special problem of the postoperative or postanæsthetic shock

This special aspect however has been investigated from the clinical point of view in a series of papers by Levi Potter Mackay and Miller and Mekie All these investigators are in agreement that the blood sugar is raised in the condition of surgical shock and following anæsthesia In the paper by Miller and the present writer conclusions *inter alia* were made which were of such fundamental importance as to warrant investigation of their correctness by laboratory experiment These conclusions were

1 Following operations under general anæsthesia there is usually an increase in the blood sugar content but there is never a hypoglycæmia

2 The maximum rise is seen immediately after operation and from this point there is a

fall to the pre operative level which is reached in approximately 8 hours

3 There is a close relationship between the absolute rise of blood sugar and the duration of the anæsthesia

4 In cases of postoperative shock the blood sugar content is high

Three experimental problems therefore were studied (a) the effect of anæsthesia and traumatic shock on the blood sugar content (b) the source from which the increase of blood sugar comes (c) the mechanism of the reaction

At this point it is convenient to review the literature which bears on this subject

The clinical observation of Cannon to which reference has already been made that there was no evidence of hypoglycæmia in cases of shock was not borne out by the observation of Fabre who with his collaborators also studied the metabolic functions in cases of shock They state in their conclusions

Enfin dans deux cas les auteurs ont note une diminution tres sensible du glucose du sang 0 gr 32 et 0 gr 26 par litre au lieu de 1 gr 25 en moyenne chez le sujet normal Cet ensemble de faits accuse un trouble dans le metabolisme azote et un trouble dans le metabolisme des hydrates de carbone il plaide en faveur d'une alteration des fonctions hepatiques

Experimentally the question of the place shock has in the production of hyperglycæmia has been studied by Aub and Wu (1) These observers found that the level of the blood sugar was not raised in animals when the blood pressure was lowered by the increasing of the intrapericardial pressure but that if the animals were subject to traumatization of the leg muscles with the production of a state of

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The clinical observation of Cannon to which reference has already been made that there was no evidence of hypoglycæmia in cases of shock was not borne out by the observation of Fabre who with his collaborators also studied the metabolic functions in cases of shock. They state in their conclusions:

Enfin dans deux cas les auteurs ont noté une diminution très sensible du glucose du sang 0 gr 32 et 0 gr 26 par litre au lieu de 1 gr 25 en moyenne chez le sujet normal. Cet ensemble de faits accuse un trouble dans le métabolisme azoté et un trouble dans le métabolisme des hydrates de carbone il plaide en faveur d'une altération des fonctions hépatiques.

Experimentally the question of the place shock has in the production of hyperglycæmia has been studied by Aub and Wu (1). These observers found that the level of the blood sugar was not raised in animals when the blood pressure was lowered by the increasing of the intrapericardial pressure but that if the animals were subject to traumatization of the leg muscles with the production of a state of

surgical shock there was at the same time a rise in the level of the blood sugar. Aub and Wu suggest as the causal factors in the phenomenon (a) the activity of the sympathetic nervous system (b) the reduction of the total metabolism with an accumulation of the glucose in the blood the respiratory quotient suggesting that at least a normal proportion of the carbohydrates are being mobilized (c) a condition of liver insufficiency due to toxic changes with a consequent outflow or escape of glucose into the circulation.

Jean La Barre followed up these observations of Aub and Wu and investigated the changes in the blood sugar which follow the injection of histamine with the consequent production of a condition of shock.

The following summarizes his conclusions:

1. A rise in the blood sugar occurs in animals suffering from shock induced by histamine.

The rise of the sugar content does not solely depend on the action of the sympathetic system (adrenaline) since the same hyperglycemia occurs after the excision of the suprarenals.

3. He believes that the hyperglycemia is due to an intense stimulation of the vagal nerves passing to the liver. (The same experimenter reports later a second series of investigations which follow up the previous observations.)

4. He found that by ligaturing the portal vein there was either a smaller rise in the blood sugar content or else an immediate hypoglycemia upon the injection of histamine.

5. That following the injection of histamine the glycogen content of the liver could be shown to be reduced.

6. That hyperglycemia could be induced by the electrical stimulation of the vagi nerves but that this could be prevented by the previous administration of atropine.

7. That atropine could prevent death ensuing on the administration of what was normally a lethal dose of histamine and that in these cases the glycogen content of the liver was not reduced.

8. That the administration of ergot prevented the onset of hyperglycemia which follows the injection of adrenaline but does not

prevent the rise in the blood sugar which follows the injection of histamine.

La Barre also showed that there was a hyperglycemia during anaphylactic shock while Neill, Manwaring and Moy have shown that following anaphylactic shock there is a reduction in the sugar content of the liver.

Kendzierski supports the view that there is an action on the vagal fibers and suggests that the actual mechanism is by means of the ferment glycogenolase. This observer came to this view as the result of experiments on two groups of dogs, one group being normal and the other having both vagi nerves degenerated before the experiment took place.

Foncin and Sandor investigated the effect of injection of colloidal sulphur and at the end of their dissertation they comment that the changes which can be caused by the injection of other colloids depend not on any specific action of the sulphur molecule but upon it being in a colloidal state and therefore giving rise to some degree of shock. These authors make the rather interesting suggestion though their methods of deduction are difficult to follow that in the dogs experimented on the rise or the fall in the level of the blood sugar depended on whether the animal was a sympathotonic or a vagotonic.

Kellaway and Cowell who had investigated the action of histamine some years before La Barre came to rather different conclusions as to the mode of action of this drug. They consider that the effects are due in part to the outpouring of adrenaline following upon direct action of the histamine on the suprarenal cell.

The outpouring of adrenaline would of course cause a rise in the blood sugar and therefore the behavior of the adrenal during operation and the allied condition of surgical shock require consideration.

Cannon (4) in 1911 made a study of the glycosuria which occurs during the emotional states and he showed that the degree of glycosuria varies with the degree of the emotion and that the removal of the suprarenal prevents the onset of glycosuria subsequent upon even violent emotion. His experimental work led him to the opinion that asphyxia resulted in an outpouring of adrenaline and he likewise demonstrated that following the

stimulation of the sciatic nerve by a tetanizing current the adrenaline content of the blood was increased

Elliott in an article on the "Control of the Suprarenal Glands by the Splanchnic Nerves" describes an investigation into the part played by the suprarenals in resisting the various processes harmful to the body. He states that the glands suffered rapid exhaustion in cases of microbic infection repeated hæmorrhage and surgical shock. The following is a summary of his experiments on the cat

1 Fight induced by the administration of morphia or tetrabrydronaphthalamine exhausts the residual adrenaline

2 All ordinary conditions of anæsthesia with ether chloroform or urethane are attended by the exhaustion of the adrenaline

3 Excitation of afferent nerves such as the sciatic or direct injury to the brain or by the use of faradism cause loss of adrenaline

4 The afferent path is by the splanchnics and their section appears to prevent this exhaustion. Ether chloroform and the other drugs such as pilacarpine physostigmine (histamine) and even diphtheria toxin appear to have no exhausting action directly on the suprarenals

This experimental work is borne out and complemented by the report of a German writer (Deucher) who pointed out that the suprarenal cortex shows signs of exhaustion in cases of fatal peritonitis

Bedford interested in the adrenaline exhaustion theory of shock investigated the epinephric content of the blood in conditions of low blood pressure and shock. He produced shock by the handling of the intestines and the low blood pressure by simple hæmorrhage and by the occlusion of the inferior vena cava. He came to the conclusion that in all these experiments the adrenaline content of the blood is definitely increased. He infers that the function of the adrenaline is to act as a reserve for times of special stress and as a last line of defense against the falling blood pressure of the shock condition. He quotes Bainbridge and Corbett (6) who on histological grounds concluded that subsequent to shock the glands were exhausted and points out that this observation is confirmation of

his deduction and observations. Muns (quoted by Bedford) points out that in shock the peripheral vessels are contracted as they would be in hyperadrenalization of the blood

It must be stated however that Crile at an earlier date made the statement that in animals traumatized under anæsthesia there was no augmentation of the adrenal content of the blood

The general conclusions of Bedford are worth recording here even if they do not refer directly to the problem of hyperglycæmia

1 During the condition of low blood pressure and shock an increased quantity of adrenaline is thrown into the blood

This increase in the blood is due to the activity of the adrenal gland which may become exhausted

3 The adrenaline content increases only after a prolonged continuation of the low blood pressure or shock

4 The adrenaline content quantitatively increases with the prolonged continuation of the period of shock

5 The adrenaline mobilization is the last effort on the part of the organism to resist forces tending to a fatal degree of low blood pressure

Stewart and Rogoff writing 2 years later state that in similar experiments to those of Bedford they were unable to confirm his results

While Corbett reported that he had found microscopical evidence of the exhaustion of the adrenals. Short in cases of shock which had proved fatal among his cases in 1914 held the opposite view

Underhill found that while dilute solutions of adrenaline failed to produce glycosuria in animals the same quantity of adrenaline produced a glycosuria when the animals were under the influence of urethane

Olmsted considered the relationship which the adrenals bear to asphyxia. According to this investigator the blood sugar in decerebrate cats is always high because of the anæsthetic employed. During asphyxia this level is surpassed and the rise in the blood sugar is proportional to the hydrogen ion concentration of the blood. The effect of the asphyxia can however be markedly modified

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4 The afferent path is by the splanchnics and their section appears to prevent this exhaustion. Ether, chloroform and the other drugs such as pilocarpine, physostigmine (hustamine) and even diphtheria toxin appear to have no exhausting action directly on the suprarenals

This experimental work is borne out and complemented by the report of a German writer (Deucher) who pointed out that the suprarenal cortex shows signs of exhaustion in cases of fatal peritonitis

Bedford, interested in the adrenaline exhaustion theory of shock, investigated the epinephric content of the blood in conditions of low blood pressure and shock. He produced shock by the handling of the intestines and the low blood pressure by simple hæmorrhage and by the occlusion of the inferior vena cava. He came to the conclusion that in all these experiments the adrenaline content of the blood is definitely increased. He infers that the function of the adrenaline is to act as a reserve for times of special stress and as a last line of defense against the falling blood pressure of the shock condition. He quotes Bainbridge and Corbett (6) who on histological grounds concluded that subsequent to shock the glands were exhausted and points out that this observation is confirmation of

his deduction and observations. Muns (quoted by Bedford) points out that in shock the peripheral vessels are contracted as they would be in hyperadrenalinization of the blood

It must be stated however that Crile at an earlier date made the statement that in animals traumatized under anæsthesia there was no augmentation of the adrenal content of the blood

The general conclusions of Bedford are worth recording here even if they do not refer directly to the problem of hyperglycæmia

1 During the condition of low blood pressure and shock an increased quantity of adrenaline is thrown into the blood

This increase in the blood is due to the activity of the adrenal gland which may become exhausted

3 The adrenaline content increases only after a prolonged continuation of the low blood pressure or shock

4 The adrenaline content quantitatively increases with the prolonged continuation of the period of shock

5 The adrenaline mobilization is the last effort on the part of the organism to resist forces tending to a fatal degree of low blood pressure

Stewart and Rogoff, writing 2 years later, state that in similar experiments to those of Bedford they were unable to confirm his results

While Corbett reported that he had found microscopical evidence of the exhaustion of the adrenals, Short in cases of shock which had proved fatal among his cases in 1914 held the opposite view

Underhill found that while dilute solutions of adrenaline failed to produce glycosuria in animals, the same quantity of adrenaline produced a glycosuria when the animals were under the influence of urethane

Olmsted considered the relationship which the adrenals bear to asphyxia. According to this investigator the blood sugar in decerebrate cats is always high because of the anæsthetic employed. During asphyxia this level is surpassed and the rise in the blood sugar is proportional to the hydrogen ion concentration of the blood. The effect of the asphyxia can however be markedly modified

surgical shock there was at the same time a rise in the level of the blood sugar Aub and Wu suggest as the causal factors in the phenomenon (a) the activity of the sympathetic nervous system (b) the reduction of the total metabolism with an accumulation of the glucose in the blood the respiratory quotient suggesting that at least a normal proportion of the carbohydrates are being mobilized (c) a condition of liver insufficiency due to toxic changes with a consequent outflow or escape of glucose into the circulation

Jean La Barre followed up these observations of Aub and Wu and investigated the changes in the blood sugar which follow the injection of histamine with the consequent production of a condition of shock.

The following summarizes his conclusions

1 A rise in the blood sugar occurs in animals suffering from shock induced by histamine

2 The rise of the sugar content does not solely depend on the action of the sympathetic system (adrenaline) since the same hyperglycemia occurs after the excision of the suprarenals

3 He believes that the hyperglycemia is due to an intense stimulation of the vagal nerves passing to the liver (The same experimenter reports later a second series of investigations which follow up the previous observations)

4 He found that by ligaturing the portal vein there was either a smaller rise in the blood sugar content or else an immediate hypoglycemia upon the injection of histamine

5 That following the injection of histamine the glycogen content of the liver could be shown to be reduced

6 That hyperglycemia could be induced by the electrical stimulation of the vagi nerves but that this could be prevented by the previous administration of atropine

7 That atropine could prevent death ensuing on the administration of what was normally a lethal dose of histamine and that in these cases the glycogen content of the liver was not reduced

8 That the administration of ergot prevented the onset of hyperglycemia which follows the injection of adrenaline but does not

prevent the rise in the blood sugar which follows the injection of histamine

La Barre also showed that there was a hyperglycemia during anaphylactic shock while Neill Manwaring and Moy have shown that following anaphylactic shock there is a reduction in the sugar content of the liver

Kendzierski supports the view that there is an action on the vagal fibers and suggests that the actual mechanism is by means of the ferment glycogenolase This observer came to this view as the result of experiments on two groups of dogs one group being normal and the other having both vagi nerves degenerated before the experiment took place

Foncin and Sandoz investigated the effect of injection of colloidal sulphur and at the end of their dissertation they comment that the changes which can be caused by the injection of other colloids depend not on any specific action of the sulphur molecule but upon it being in a colloidal state and therefore giving rise to some degree of shock These authors make the rather interesting suggestion though their methods of deduction are difficult to follow that in the dogs experimented on the rise or the fall in the level of the blood sugar depended on whether the animal was a sympathotonic or a vagotonic

Kellaway and Cowell who had investigated the action of histamine some years before La Barre came to rather different conclusions as to the mode of action of this drug They consider that the effects are due in part to the outpouring of adrenaline following upon direct action of the histamine on the suprarenal cell

The outpouring of adrenaline would of course cause a rise in the blood sugar and therefore the behavior of the adrenals during operation and the allied condition of surgical shock require consideration

Cannon (4) in 1911 made a study of the glycosuria which occurs during the emotional states and he showed that the degree of glycosuria varies with the degree of the emotion and that the removal of the suprarenals prevents the onset of glycosuria subsequent upon even violent emotion His experimental work led him to the opinion that asphyxia resulted in an outpouring of adrenaline and he likewise demonstrated that following the



Fig 2

reached about 75 minutes after the commencement of narcosis. A typical graph illustrating the progressive rise in the blood sugar during anesthesia is shown in Figure 1.

A series of 10 experiments were carried out for the specific purpose of demonstrating the immediate changes which occur on the administration of an ether anæsthetic. The narcosis was rapidly induced the animal passing into complete surgical anesthesia within an average of $1\frac{1}{2}$ minutes thereafter anesthesia was maintained at a constant depth and care was exercised to prevent the animal becoming in any degree asphyxiated. The smoothness of the anesthesia was difficult to obtain in some of our earlier cases owing to the administration of ether by the drop bottle but later when we perfected a technique of vaporization of ether our results were more satisfactory.

The technique employed was to pass a regulated flow of air through a bottle of ether and the vapor was then conducted by a rubber tube to a closely fitting metal mask. By this means we were able to carry out prolonged anesthesia at a constant depth of narcosis and unaccompanied by any evidence of asphyxia.

The sugar content of the blood was obtained frequently during the first hour and a half of anesthesia and the results are given in Figure 2.

The figures show that the blood sugar rises progressively and a graph plotted from these average increments lie in close proximity

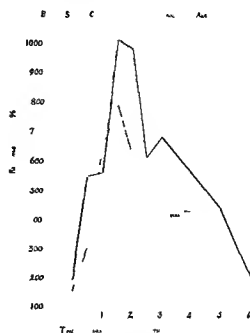


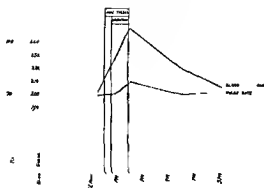
Fig 3

to a slightly curved climbing graph. It is apparent of course that such a progressively rising hyperglycemia cannot be indefinitely prolonged and experiment revealed that the maximal rise was reached after 60 to 90 minutes narcosis.

This investigation was carried out on three rabbits and anesthesia continued until the fall in the blood pressure in two cases became so low that specimens of blood could not be obtained and in the third animal up to the time of death (Fig 3).

That the degree of hyperglycemia is dependent on the duration of the anesthesia rather than on the quantity of ether administered or on the depth of narcosis was demonstrated by two similar experiments. Two animals were prepared as above and estimations of the blood sugar made before the commencement of the ether administration. For a period of 30 minutes the rabbits were kept at a constant depth of anesthesia and thereafter the narcosis was gradually deepened so that after 15 minutes death ensued.

The graphs obtained illustrated that in these cases the blood sugar rises to a very high level and that this high level is maintained even at the time of death but there does not appear to be any special relationship between the rate of rise of the blood sugar and the depth of the anesthesia.



Fg

if the adrenals are thrown out of action by ligaturing their vessels or in cases in which the splanchnic nerves have previously been sectioned

Bulatao and Cannon (3) report however that in decerebrate cats they obtained a hyperglycemia following the administration of ether or asphyxia even after the nerves to the liver and suprarenals have been cut

From the result of her clinical work to which reference has already been made Dorothy Potter raises the question of the relationship of the blood sugar content to the alkali reserve. She points out how in anæsthesia there is a rise in the phosphate content of the blood. This she contends is an attempt on the part of the body to deal with the increased quantity of acid associated with anæsthesia. Our present interest in this question lies in the fact that the phosphate reserve in the muscle is combined with glucose and that during the period of anæsthesia hexose phosphoric acid leaves the muscle and accumulates in the blood stream. The effect of this on the level of the blood sugar may well be of very great significance.

So far as present investigation has shown there has been no work done on the relationship of the internal secretion of the pancreas to any of the factors found in the postoperative period.

From the evidence available there now appears to be no doubt that following anæsthesia the blood sugar rises but little effort has been made to study the nature and details of the phenomenon under laboratory conditions or to explore the mechanism of reaction.

From what has already been epitomized from the available literature it appears that a hyperglycemia is not an infrequent response to a variety of stimuli most of which occur together in the course of a single operative procedure—anæsthetization trauma shock stimuli of nerves etc.

It has been the writer's purpose to attempt to study this problem both clinically and experimentally with a view to elucidating some of these problems more especially from those aspects of the subject which bear directly on clinical surgery.

The mechanism of the hyperglycemia is a problem interesting to both the physiologist and the biochemist. Some effort has been made to answer the physiologist's 'how?' but the exact biochemical processes have not been studied such investigation being beyond the scope of the present work.

In the experimental work in order to make the results as uniform as possible it was decided to use rabbits solely as the subjects of the experiments and to use ether as the only anæsthetic. The estimations of the sugar content of the blood were made by Benedict's technique which allows of some delay between the obtaining of the specimen and the carrying out of the estimation.

In all experiments the animals were given no special preparation up to 3 hours before the commencement of the observations when their feed was withdrawn. A sample of blood for sugar investigation was invariably procured immediately before the commencement of the anæsthetic as a control reading for that animal.

THE PHENOMENON

It was shown in the previous work undertaken by Miller and the present writer that immediately upon the administration of an anæsthetic the patient's blood sugar rose and evidence was put forward that the rise at any rate for the first 75 minutes of anæsthesia was a progressive one. The graphs available as the result of our clinical investigation did not enable us to dogmatize as to the changes which might occur under still more prolonged anæsthesia but two cases which came under review suggested that the peak point of anæsthesia hyperglycemia was

trolled by a light clamp. The course of the hepatic blood sugar content is also shown on the graph. The graph shows that the systemic blood sugar content remains constant—such variations as occur being within the limit of experimental error (Fig. 5).

The liver sugar rises to a very high level and it was noted that in 3 of the 4 graphs showing the hepatic blood sugar content in the estimation made on the sample procured immediately after death the reading was the highest obtained.

These experiments seem to me to be conclusive evidence that the rise in the blood sugar content under anæsthesia is due to hepatic action and that the muscles can play only a secondary part in the phenomenon if any.

To control these experiments the opportunity was subsequently taken (not graphed) to compare the sugar content of blood derived from the liver and the general systemic blood in some experiments in which there was no interference with the hepatic circulation. In every instance the figures closely corresponded and were within possible experimental error.

There is a further inference which may be drawn from the experiments detailed above namely that during anæsthesia there is no increase of tissue carbohydrate metabolism since in none of my experiments was there evidence of any drop in the sugar content of the blood such as might be expected after prevention of ingress to the blood stream of carbohydrate from the liver.

THE MECHANISM OF ETHER HYPERGLYCÆMIA

From the study of the literature already made it will be observed that various investigators have suggested methods which result in the mobilization of liver glycogen in shock and anæsthesia. Thus Aub and Wu suggest the causal factors (1) sympathetic nervous system activity and (2) toxic changes in the liver.

Jean La Barre states that he excluded the adrenaline factor and mentions vagal stimulation as the essential mechanism. Kendzierski supports this latter view.

Kellaway and Cowell are advocates of the adrenaline theory of hyperglycæmia produc-

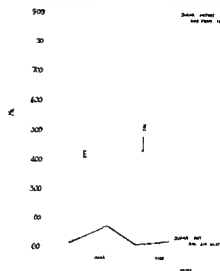


Fig. 5

tion and are supported by Elliott, Bedford, Bambridge and Corbett and Muns. Underhill also supports this view and his observations on the effect of dilute solutions of adrenaline on animals under anæsthesia are of interest.

So diverse were the reports and so frequent the contradictions that it was felt advisable to study the question by personal experiment. Briefly stated there were four possible mechanisms of production (1) by sympathetic stimulation (2) by vagal stimulation (3) by production of an outpouring of adrenaline, and (4) by direct action on the liver.

Sympathetic stimulation. That sympathetic stimulation will produce a mobilization of hepatic glycogen is a known fact and there appeared to be no reason to re-investigate the matter. The question however of the effect of ether upon this possible mechanism did not lend itself to direct proof. However in ergotoxin a drug is available which paralyzes the sympathetic nerve endings (Cusbnv). A dosage of 1 milligram per kilogram of body is sufficient effectively to secure this effect (Dryerre).

In the experiments the animals were given the appropriate amount of ergotoxin intramuscularly 10 minutes before administration of ether. That the ergotoxin was producing its biological action was shown by the intense spasm of the peripheral vessels, a spasm so severe that it was impossible to obtain specimens of blood except by cardiac puncture or

THE ETIOLOGY OF ENDOMETRIAL HYPERPLASIA

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NASHVILLE TENNESSEE

F m h D p tm t f Ob d Gyn l gy d th D p tm f A t my V d b l t U y School M d

THE subject of idiopathic uterine bleeding has long been one of the greatest problems in the field of gynecology. The frequency of the condition and the difficulty in obtaining adequate but conservative treatment has incited a very large amount of work concerning this condition. Many clinical reports have appeared in the literature together with much discussion of a theoretical character.

The exact etiology of this condition has not been determined although the doctrine of a deficiency of the corpus luteum has been advanced. This theory was first proposed by Schroeder but was not generally accepted. Recently however Shaw in a brilliant contribution confirmed Schroeder's observations in detail. Further observations have come from Novak and Martzloff and Graves in this country. From the morphological viewpoint Cullen and his pupils were among the first to carry out careful and thorough histological studies on cases of this kind.

Two lines of study have contributed to the conclusions presented in this paper. We have examined histologically the materials obtained by curettage from a series of 28 cases of prolonged uterine bleeding and from a series of patients who have presented quite normal menstrual histories. In addition we have studied the effects produced by extracts of placenta and corpus luteum when administered to spayed mice. The results of these various observations have seemed sufficiently striking and interrelated to justify their being reported here.

Before discussing these findings it seems desirable to review briefly the outstanding facts which serve to correlate the menstrual cycle of the human with the estrual cycle of experimental animals.

Allan has accurately described this cycle for the mouse. The unmated mouse has a period of estrus every 4 to 6 days. At the

time of estrus a characteristic change takes place in the vagina. This change consists of a cornification of the vaginal mucosa which is easily determined by means of smears. Ovulation takes place during the latter part of the estrual phase but the corpus luteum remains inactive unless the animal is allowed to copulate.

When the female is mated with a vasectomized male a stage of pseudopregnancy follows. This stage of pseudopregnancy corresponds to that period of the human menstrual cycle lying between the fourteenth and twenty-eighth days. Its main characteristics are a growth of the uterine mucosa which in the essential details is similar to the human premenstrual endometrium together with slight enlargement of the uterus. The time before the next estrual period in the mouse is prolonged by pseudopregnancy from the normal 4 to 6 day interval to an 8 to 14 day interval.

While we are not concerned at this point with the method of activation of the corpus luteum we know that following copulation it becomes active and that this activity is the cause of the pseudopregnancy. When the corpus luteum has ceased to function the normal 4 to 6 day cycle is again restored. If copulation does not take place the corpus luteum is not activated and the uterus of the animal undergoes involution until it reaches its resting stage. Two to three days before estrus the epithelium becomes markedly active; the gland cells multiply and numerous mitotic figures are present. There is definite pseudostratification of the epithelium and a fair amount of secretion is found in the lumen of the gland. There is marked edema of the stroma. The stroma cells are rather small but are proliferating as occasional mitoses are seen. When the pseudopregnant condition occurs the gland cells lose their pseudostratified arrangement and become more regular. No mitoses are present. The stroma cells become

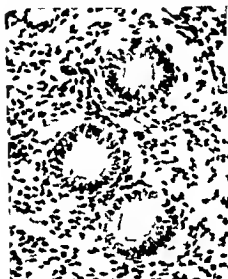


Fig 1



Fig 2



Fig 3

Fig 1 Photomicrograph of section of human endometrium 6 days after menstruation. Note the uniform dilatation of the glands and the pseudostratification of the epithelium. The epithelial cells are high columnar. The stroma is oedematous and one mitotic figure is shown. Gyn No 788 $\times 225$.

Fig 2 Photomicrograph of section of human endometrium 13 days after menstruation. Note the oedematous

stroma, the irregular but high columnar epithelium and the pseudostratification. Gyn No 214 $\times 225$.

Fig 3 Photomicrograph of section of human endometrium 22 days after menstruation. The epithelium is low columnar and cuboidal in type. The nuclei are centrally placed. No mitoses were seen. Note the size of the stroma cells in contrast to those of the section shown in Figure 1. Gyn No 724 $\times 225$.

larger and there is less oedema. Therefore in the mouse we have two distinct phases, one before ovulation and one after.

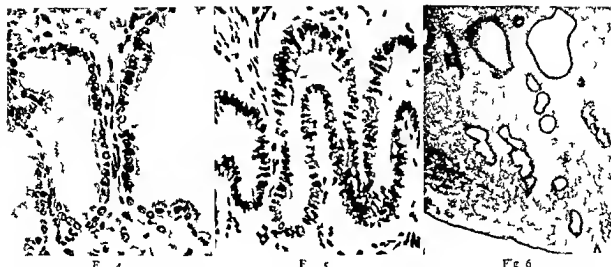
In the human female following the cessation of the menstrual period the uterine epithelium is low columnar in type. There are no mitoses and no secretion in the glands. The stroma is fairly compact but is moderately oedematous. In a few days a period of growth of the epithelium is begun. The gland cells multiply, mitoses can be found, and the mucosa increases in thickness. The cells are slightly enlarged and the oedema becomes somewhat more prominent. The glands themselves lengthen out and have a tendency to a spiral or corkscrew course, and the epithelium tends to become high columnar.

Following ovulation the corpus luteum forms. In the human this structure functions irrespective of the act of copulation. Following ovulation the endometrium increases in thickness, but its appearance and histological characteristics are markedly changed. Numerous tufts or papillae project into the lumen of the glands. The glands become more dilated, the nuclei of the epithelial cells assume a more central position, there are no mitoses, and

no pseudostratification. The stroma cells increase in size and form a compact layer in the upper portion. Later, around the twenty-fifth day, the oedema reappears in the stroma and becomes quite marked, and there is a fading out of the gland cells into the lumen. The glands contain secretion. From this brief description it can readily be seen that the changes occurring in the human are very similar to those occurring in the mouse.

Allen and Doisy, Frank, and others have isolated a hormone from follicular fluid and placenta which, when injected into spayed mice, causes the typical picture of estrus in the uterus and vagina. Allen and Corner have isolated another hormone which, when injected into the rabbit, causes a reproduction of the changes found in pseudopregnancy. They have been able to maintain pregnancy after the removal of the ovaries by means of this extract.

The studies of Frank and Margaret Smith have shown that the estrus-producing hormone can be found in detectable amounts in the blood of humans beginning on the fourteenth day and increasing until the menstruation period.



F 4

F 5

F 6

Fig 4 I h t m g p h f s e c t f h m d m
t m 3 d y f t m t o n T h c l l e s o m w h t
l g t h t h s e s h o w n F g u e 3 b t s m l a r t y p e
N o m u t w e r e G y n N 6 3 X 25
Fig 5 Photom p h o f t o f h m n d m

t m o d y f t m e s t r u t N t e i r r e g u l e p
t h e l i u m d t h m a r k e d a d m a f t h e s t r o m a G y n N o
728 X
1 6 S e c t o f t h d m t r u m f r o m c a s e o f S u s
c h h y p r p l a G y n N 414 X 56

Parallel with this increase in estrin the corpus luteum becomes active and gives off its hormone. The experiments of Patel and others have indicated that there is a certain antagonism between these hormones as regards the production of estrus and a synergism as regards growth activity of the endometrium. It is fairly clear then that the changes preceding ovulation are the result of the estrus hormone and that the changes following ovulation are the result of the combined action of these two hormones. From this standpoint—attempting to correlate morphological change with hormonal activity—we have approached the problem of interpreting uterine scrapings. This has seemed eminently desirable to us because heretofore no accurate criteria have been obtained concerning the intimate nature of these changes. Hyperplasias of the endometrium have long been known to be a result of a disordered ovarian activity but it has not been possible to determine the exact type of this disorder from examination of the curettings.

Schroeder Shaw and Graves have made important contributions to this subject and have found that there are no corpora lutea in the ovaries of the Swiss cheese hyperplasias and that invariably the ovaries are cystic. It is apparent of course from this work that a

disproportion between the two hormones resulting in a large excess of estrin is a factor in the production of the disease. The logical inference therefore is that hyperplastic changes are the result of the unopposed action of the estrin hormone. Experimental proof of this inference has so far been lacking. We present the following experiments in support of this hypothesis.

OBSERVATIONS

In this study we have made a careful histological survey of numerous specimens of the human endometrium at various stages of the menstrual cycle. The findings from this material were compared with the histological changes of the endometria of spayed mice which had been injected with extracts of estrin and corpus luteum and with a combination of the two. From these comparisons it was possible to gain an idea of the histological appearances which the various hormones produced.

Sections from 28 cases of Swiss cheese hyperplasia were studied in the light of these comparisons and were found to be similar in many respects to the normal endometrium of the sixth to fourteenth day and to the experimental endometria produced by the injections



Fig 7



Fig 8



Fig 9

Fig 7 Photomicrograph of section from uterus of mouse L 4. This animal had been previously spayed. It was injected subcutaneously with 1 cubic centimeter of corpus luteum extract daily for 3 days and was killed on fifth day. Note the low columnar epithelium and absence of mitoses. Smears and sections of the vagina from this animal indicated that it was in the di-estrous stage. $\times 260$

Fig 8 Photomicrograph of section from uterus of mouse C L 7. This animal had been previously spayed. It was injected subcutaneously with 1 cubic centimeter of corpus luteum extract daily for 3 days and was killed on

the fifth day. Note the low columnar epithelium and the absence of mitoses. Smears and sections of the vagina from this animal indicated that it was in the di-estrous stage. $\times 260$

Fig 9 Photomicrograph of section from uterus of mouse P 2. This animal had been previously spayed. It was injected subcutaneously with 0.35 cubic centimeter of extract of human placenta daily for 3 days and was killed on the fifth day. Note the high pseudostratified epithelium. Two mitoses are shown in the epithelium. There was moderate edema of the stroma. $\times 260$

of estrin. Two typical cases of Swiss cheese hyperplasia from which both the uterus and ovaries were available for study were observed in the clinic. In each of these cases a follicular cyst was present. Fluid from these cysts was injected into spayed mice and rats and the endometria from these animals were compared with that from the human uterus.

Normal human endometrium. It is unnecessary to describe the human endometrium in detail but we wish to call attention to those points which we consider significant as regards this study.

On the sixth day the glands are round containing little or no secretion (Fig 1). The cells are high columnar, mitoses are frequently observed and there is a piling up of the surface epithelium with a resultant pseudostratification. The stroma cells are small and there is some edema. On the thirteenth day (Fig 2) the glands are larger and the changes are more exaggerated. This represents the height of the estrin phase.

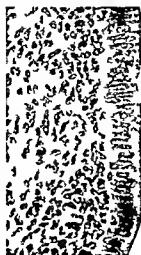
From the fourteenth to the twenty eighth day is the phase during which both the corpus luteum and the estrin hormones are active. On the sixteenth day the stroma cells are a little larger, mitoses cannot be found and the gland cells are becoming more regular with a tendency to be low columnar rather than high columnar in shape. The nuclei are more centrally located. On the twenty second and the twenty third days the stroma is more compact, the gland epithelium is low columnar and the cells are regular and do not show mitoses (Figs 3 and 4).

On the twenty ninth day (Fig 5) there is more edema in the stroma, there is a tendency of the cell borders to lose their sharp contour on the side adjacent to the lumen and to fade out into a mass of secretion.

We wish to stress in the study of the human endometrium the transition from the pseudostratified actively growing high columnar epithelium of the estrin phase to the low columnar, moderately regular and quiescent



Fig 10



I



Fig 2

Fig 10 Ph t m c o g p h f t f m uterus f
P 3 Th m a l h d p l y b e s p a y d I t
i n j e c t e d b e u t a l y w t h 0.35 c b c c e n t m t o f
t c t o f h m p l t d l y f 3 d a y d w k l l d
b e f i f t h d y N t t h h g p u d o s t t f d p t h l m
w m t h w n t h e p t h l m Th w
n k d e e d m f t h t r o m X 60
Fig 10 Ph t m c o g p h f t f m uterus f
P 3 Th m a l h d p l y b e s p a y d I t
i n j e c t e d b e u t a l y w t h 0.35 c b c c e n t m t o f
t c t o f h m p l t d l y f 3 d a y d w k l l d
b e f i f t h d y N t t h h g p u d o s t t f d p t h l m
w m t h w n t h e p t h l m Th w
n k d e e d m f t h t r o m X 60

et at f corpus luteum d l y f 3 d y d k l l d the
f i f t h d y Th p t h e l m s u m l a r t t h t h o w n i n F e u e
9 N o t t h e m t i s n t h p p p o r t f t h f i l d X 60
Fig 2 Ph t m c o g p h f t f m uterus f
P 3 Th m a l h d p l y b e s p a y d I t
i n j e c t e d b e u t a l y w t h 0.35 c b c c e n t m t o f
t c t o f h m p l t d l y f 3 d a y d w k l l d
b e f i f t h d y N t t h h g p u d o s t t f d p t h l m
w m t h w n t h e p t h l m Th w
n k d e e d m f t h t r o m X 60

epithelium of the combined corpus luteum and estrin phase

Mouse endometrium Spayed adult mice were used. These were injected with varying amounts of extracts of placenta and corpus luteum separately and in combination. These extracts were prepared by the method described by Corner and Allen.

Effects produced by extract of placenta The mice which received the placental extract uniformly showed an enlargement of the cavity of the uterus (Figs 9 and 10). The gland cells were actively growing pseudostratified and showed numerous mitoses. The stroma cells were slightly enlarged. There was an occasional mitosis in the stroma and a moderate amount of edema. The intensity of these changes varied according to the amount and potency of the extract.

Effects produced by extract of corpus luteum In interpreting the changes found following injections of corpus luteum one should bear

in mind that it is impossible to remove all traces of estrin from corpus luteum extracts. As a result of this presence of estrin all mice injected with extracts of corpus luteum showed a mixed effect of the two hormones. The picture varied according to the predominance of one or the other hormone. The character of this predominance was determined by the presence or absence of typical estrual changes in the vagina. In cases in which there was a distinct alteration of the histological character of the uterus and no estrual changes in the vagina a predominance of the corpus luteum hormone was assumed. On the other hand in cases in which estrual changes occurred in the vagina a predominance of the estrin hormone was assumed.

In most of our experiments with corpus luteum hormone there was no evidence of estrus. One lot of the extract produced estrus in a few spayed mice when given in large doses and here a typical mixed effect was

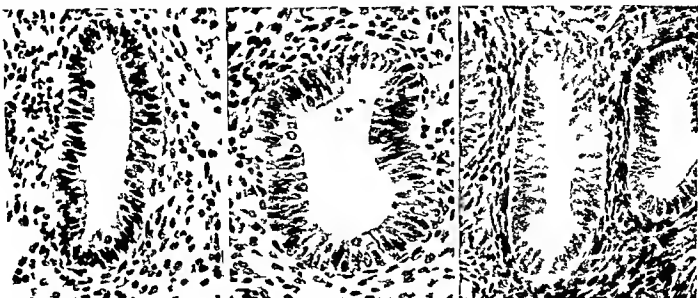


Fig 13

Fig 14

Fig 15

Fig 13 Photomicrograph of section from endometrium of a case of hyperplasia Gyn No 414 $\times 235$

Fig 14 Photomicrograph of section from endometrium of a case of hyperplasia Gyn No 484 $\times 235$

Fig 15 Photomicrograph of section from endometrium

of a case of hyperplasia. There was a small ovarian cyst in one ovary in this case which was aspirated at operation and the fluid injected into spayed rats (See Figures 16 and 18) Gyn No 1569 B $\times 235$

present In all the other experiments the uterine epithelium was of a low columnar type there was usually some evidence of secretion no mitoses were observed the stroma was compact and there was marked enlargement of the stroma cells This typical picture is shown in Figures 7 and 8 These mice had been spayed and were subsequently injected with an extract of corpus luteum They did not show any evidence of estrus

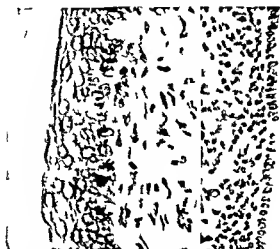
The mice which came into estrus following the injection of extract of corpus luteum showed reactions similar to those which received a mixture of the two hormones

Effects produced by mixtures of estrin and corpus luteum extracts A few spayed mice were injected with combinations of these two extracts The estrin effects predominated in these animals Here the uterine epithelium was pseudostratified mitoses occurred but were less frequent than when estrin was used alone in the same amounts The stroma cells were large but there was more oedema than in animals which had received extracts of corpus luteum alone A typical experiment is illustrated in Figure 11 This mouse received 0.75 cubic centimeter of placental extract and 1.5 cubic centimeters of corpus luteum extract for 5 days and was killed on the fifth day Figure

12 is a photomicrograph from another mouse which had been given exactly similar treatment Here however while both reactions are evident there is a slightly greater evidence of the corpus luteum effect but the presence of the estrin hormone is obvious In the left hand corner a mitosis is seen and there is pseudostratification but the epithelial cells are straighter more discrete and show more secretion than do those shown in Figure 11 The stroma cells are also somewhat larger

The great variety of combinations which it is possible to obtain each with a resultant specific effect indicates very clearly the individual characteristics of the two extracts There is however some evidence of a difference in the susceptibility of individual animals as is indicated by these two experiments

Observation on cases of hyperplasia Twenty eight cases of typical hyperplasia of the Swiss cheese type have been studied These cases presented the typical clinical syndrome of bleeding either continuously or at irregular intervals without apparent cause and came to the clinic for treatment The histological material obtained by curettage was examined and the following changes were noted (Figs 6 13 14 and 15) The glands were irregularly dilated and there was under low power exam



F 6

Fig 6 Photomicrograph of section of the gland from the patient 569 B daily for 3 days. Not typical of true epithelium $\times 5$



Fig 8

Fig 8 Photomicrograph of section of the gland from the patient 569 B daily for 3 days. The rat was killed the fifth day after the first injection $\times 5$ (The left horn of the uterus). Fig 7 was made with the same material as the cyst fluid was injected.

ination a marked Swiss cheese appearance (Fig 6). We do not consider this however as the most significant feature. The study of the gland cells and the stroma under high magnification revealed the changes described below. The gland cells were actively growing and heaped together in one or more layers in a pseudostratified fashion. Numerous mitoses were found. The stroma cells were fairly small and there was a great deal of edema. We have found this picture fairly constant throughout all sections of this type of hyperplasia. In no instance of Swiss cheese hyperplasia was anything seen which was similar to a well marked premenstrual change. We have seen a few cases of uterine bleeding in which the picture was entirely different from that described and in which the predominance of corpus luteum hormone was suggested by the appearance of the endometrium. The number of these cases however has been entirely too small to warrant any conclusions being drawn at the present time.

Injections of cyst fluid. Two cases of Swiss cheese hyperplasia were observed at operation in which no corpora lutea were found in either ovary and in which a follicle cyst was present in both cases. The fluid from these cysts was aspirated and injected into mice and rats.

Spayed female rats were given 3 cubic centimeters daily for 3 days and were killed on the fifth day. Spayed female mice were treated in like manner except the dose was $\frac{1}{2}$ cubic centimeter daily. In these animals a typical estrus reaction was observed both in the vagina (Fig 16) and the uterus (Fig 18). Similar changes were observed in sections of the human uterus from these patients (Fig 15). These changes were pseudostratification, mitoses, moderately small stroma cells and edema.

DEDUCTIONS

Fundamentally this work is an experimental analysis of the combined effects of the estrin and corpus luteum hormones in the interpretation of normal and pathological changes of the human endometrium. We suggest the abolition of the old terminology of postmenstrual and premenstrual in favor of estrin phase and estrin corpus luteum phase.

It is not within the province of this paper to discuss the relationships between the ovary and the hypophysis or between the hypophysis and the actual menstrual bleeding. We have been solely concerned with the changes preceding menstruation and in so far as the material presented in this paper is concerned we have considered it simply as the turning point

of the cycle. The results of the study indicate that Swiss cheese hyperplasia is due to an excess of estrin acting on the endometrium. We are unable to state whether this is a real excess or only an apparent excess due to a failure of the corpus luteum. The results point the way to further studies in the etiology of this interesting disease.

In Swiss cheese hyperplasias bleeding takes place without the formation of corpus luteum and this is a clinical fact which supports the work of those who maintain that menstrual bleeding can occur without ovulation. This bleeding however is abnormal and is not analogous to the regular monthly bleeding. The failure to ovulate is probably an important factor in the disease and closely connected with the hypophyseal function. At the present stage of our knowledge it seems possible that extracts of corpus luteum might have a beneficial effect on the disease provided of course a potent extract could be obtained.

CONCLUSIONS

1 The estrin hormone produces a definite and characteristic reaction on the endometrium.

2 The corpus luteum hormone produces a definite and characteristic reaction on the endometrium.

3 It is possible in cases in which mixed effects are obtained to determine by means of histological sections which is predominant.

4 The histological appearances of the endometrium obtained from cases of Swiss cheese hyperplasia are very similar to those found in animals which have been injected with extracts of placenta.

5 Material obtained from the follicle cysts of human cases of hyperplasia, when injected into mice and rats produced estrus. The changes in the uterus of each case were similar in many respects to those found in the uterus of the experimental animals receiving the fluid from that case.

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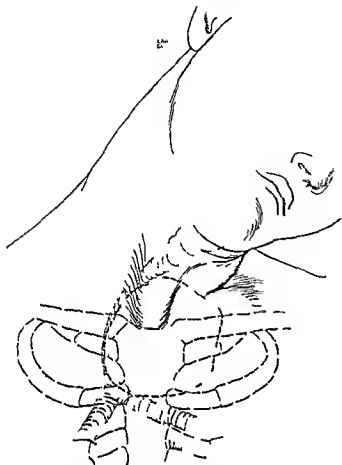


Fig 3 Showing diagrammatically why some patients with intrathoracic goiters suffer interference with breathing when sleeping with one side of the head on a pillow and no interference with the head on the other side. Note that with the head on one side the trachea becomes stretched over the intrathoracic adenoma and that the adenoma is fixed in its position by being lodged against the upper thoracic cage.

process of developing a completely intrathoracic goiter is merely the increase in diameter of the adenoma. At first the low located moderate sized adenoma of the lower pole of the thyroid may be voluntarily extruded from the mediastinum by the patient by swallowing vigorously, eventually however the adenoma becomes so great in diameter that it can no longer pass through the thoracic aperture so that the adenoma is a completely intrathoracic goiter.

Once the discrete adenoma has become completely intrathoracic the depth it may attain in the thorax depends largely upon the increase in transverse diameter of the adenoma since the tapering walls of the upper chest permit growth expansion of the tumor only by descent to lower levels in the thorax. Sometimes the lowermost point of the growth may be below the level of the aortic arch. Diagram 1 illustrates this point.

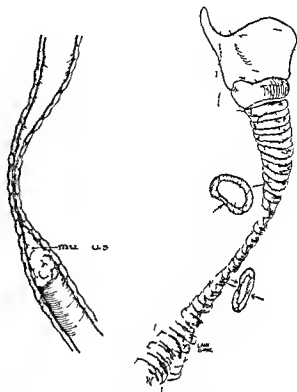


Fig 4 (left) This diagrammatic illustration shows the narrowing of the intrathoracic trachea by pressure from an intrathoracic adenoma and how a plug of mucus can readily obstruct breathing by lodging in this narrowed portion.

Fig 5 Showing diagrammatically the rotation of the larynx which not infrequently occurs with marked lateral deviation from the pressure of an intrathoracic goiter. Note that the notch of the thyroid cartilage no longer presents anteriorly but is rotated into a lateral position.

The most typically complete intrathoracic goiters are the discrete adenomata. Not infrequently the multiple adenomatous goiter of the endemic type sends prolongations deeply into the mediastinum by a process of growth prolongation of the lower poles or one of its lower poles pushes downward in the direction in which there is no muscular resistance.

In multiple adenomatous goiter the matter of growth direction seems to be haphazard and without reason. In one case the multiple adenomatous enlargement of the thyroid is almost entirely in an anterior direction thus causing attenuation of the overlying prethyroid muscles by pressure and producing the anterior bulging goiter which presents itself prominently and anteriorly on the neck. In another case the enlargement will be upward in the direction of one or both superior thyroid poles so that there will be little anterior bulging but there will be an upward spread of the goitrous enlargement beneath the sternomastoid and between the muscle planes in the neck. In



Fig 6 An X-ray picture of a partially thyroid gland. Note that the position of maximum curvature of the trachea is marked by the point of greatest lateral deviation of the trachea.

another case there will be prolongations of adenomatous thyroid tissue springing from the posterior aspect of one or both thyroid lobes to insinuate themselves behind the trachea between that structure and the esophagus and completely to encircle the trachea. An example of this type is shown in Figure 2. In the same manner projections of adenomatous thyroid tissue not infrequently start from one or both inferior thyroid



Fig 8 A completely intrathoracic goiter. Note that the position of maximum curvature of the trachea is marked by the point of maximum lateral deviation of the trachea. The intrathoracic goiter is below the level of the trachea.

poles and extend moderately or deeply into the thoracic cavity.

The symptoms produced by an intrathoracic goiter are for the most part the results of pressure of the goiter upon the trachea so that that structure is distorted and narrowed and breathing is interfered with. Since the onset of obstruction is very gradual at first patients frequently notice no difficulty in breathing even though there is enough tracheal narrowing to produce a type of breathing which is sufficiently definite to make it audible to the examiner and the patient's friends.

Several patients with intrathoracic goiters have complained that sleeping with one side of the head on the pillow produces difficulty in breathing while sleeping with the opposite side of the head on the pillow does not produce difficulty in breathing. The mechanical explanation of this phenomenon is shown in the diagrammatic illustration Figure 3 in which it may be seen that the trachea becomes stretched over an intrathoracic adenoma so that the angulation of the neck laterally increases the tension of the trachea.



Fig 7 A completely intrathoracic goiter. Note that the lateral crowning of the trachea is due to the deep intrathoracic position of the goiter. The point of maximum diameter is below the sternum.

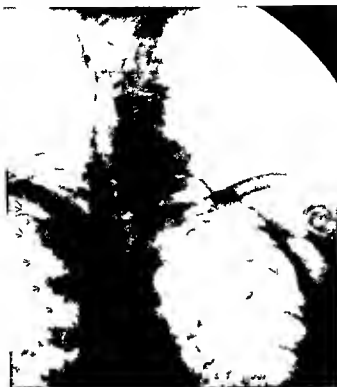


Fig. 9. A completely intrathoracic goiter on the right with an S trachea as result of counter pressure from an intrathoracic goiter on the left

against the intrathoracic adenoma which is fixed by the chest wall with resulting narrowing of the trachea

We have seen a few patients with completely intrathoracic goiters who have given a history of several experiences with threatened suffocation occurring while asleep at night and we have seen one such case occurring in a patient who was deeply narcotized by the pre operative employment of large and repeated doses of morphia. After having gone to sleep these patients have been awakened at night by choking amounting to almost complete suffocation. The wife or husband who has observed the course of this terrifying ordeal describe the patient as cyanotic struggling violently for breath finally succeeding in getting some air through into the lungs when the color clears and the attack subsides. In 2 cases this history has been repeated through several attacks but did not recur after removal of the intrathoracic goiter. In the narcotized patient the condition was relieved by the immediate incision with no anesthetic of a large intrathoracic cyst when breathing promptly returned and the patient recovered.

The most probable explanation is that during sleep there is an accumulation of mucus in the trachea below the point where the trachea is narrowed by the intrathoracic goiter (Fig. 4). During



Fig. 10. A very deep intrathoracic goiter flattening and widening the trachea from before backward. Note the depth of the intrathoracic mass as relates to the level of the arch of the aorta. The mass produced marked dilatation of the superficial chest veins, marked edema of the face and difficulty in breathing on bending over due no doubt to an increase in the anterior pressure on the trachea just as lateral bending interferes with breathing in the intrathoracic goiters laterally located.

the night while patient is in the reclining position this plug or string of mucus becomes lodged at the narrowed point in the trachea and produces complete tracheal obstruction. The patient awakens and as a result of his violent struggles to regain his breath in forcing air either into or out of his lungs expels the plug of mucus and the attack of suffocation is over. A history therefore of such attacks should cause one to investigate the superior mediastinum carefully by X-ray for a possible intrathoracic goiter.

Another diagnostic feature of intrathoracic goiter is rotation of the trachea. Marked lateral deviation of the trachea which occurs with intrathoracic goiter not infrequently causes a slight twisting or rotation of the trachea which is so imparted to the thyroid cartilage that the notch of the thyroid cartilage is rotated or dislocated laterally so that it is no longer in the median line



Fig. 2. Diagram illustrating the position of the trachea in relation to the thyroid gland. The line drawn from the chin to the sternal notch does not fall in the middle of the trachea but is well outside of it to one side or the other (Fig. 5) and when by palpation the wings of the thyroid cartilage are not asymmetrically developed one should be suspicious that the deviation or rotation is the result of deviation of the trachea from the pressure of an intrathoracic goiter and an X-ray investigation of the superior mediastinum should be made. In the cases in

When a line is drawn from the middle of the chin to the middle of the sternal notch and the notch in the thyroid cartilage does not fall in this line but is well outside of it to one side or the other (Fig. 5) and when by palpation the wings of the thyroid cartilage are not asymmetrically developed one should be suspicious that the deviation or rotation is the result of deviation of the trachea from the pressure of an intrathoracic goiter and an X-ray investigation of the superior mediastinum should be made. In the cases in



Fig. 3. Showing the primary ligament of the thyroid gland as it is displaced by the goiter. The line drawn from the chin to the sternal notch does not fall in the middle of the trachea but is well outside of it to one side or the other (Fig. 5) and when by palpation the wings of the thyroid cartilage are not asymmetrically developed one should be suspicious that the deviation or rotation is the result of deviation of the trachea from the pressure of an intrathoracic goiter and an X-ray investigation of the superior mediastinum should be made. In the cases in



Fig. 4. Showing the primary ligament of the thyroid gland as it is displaced by the goiter. The line drawn from the chin to the sternal notch does not fall in the middle of the trachea but is well outside of it to one side or the other (Fig. 5) and when by palpation the wings of the thyroid cartilage are not asymmetrically developed one should be suspicious that the deviation or rotation is the result of deviation of the trachea from the pressure of an intrathoracic goiter and an X-ray investigation of the superior mediastinum should be made. In the cases in

which there is definite rotation of the trachea a considerable portion of the intrathoracic goiter will project upward in the neck above the sternal notch and produce marked deviation and distortion of the part of the trachea between the sternal notch and the thyroid cartilage.

The final diagnosis of intrathoracic goiter rests upon the demonstration of an X-ray shadow within the thorax and more particularly upon the position of the trachea in relation to this shadow. In most instances intrathoracic goiters are so located to one side of the trachea that the structure tends to be laterally dislocated producing the typical intrathoracic shadow with the trachea curving around the portion of the goiter against which the trachea rests (Figs. 6-9).

Occasionally one sees a prolongation of a multiple adenomatous goiter directly downward behind the sternum in the middle line so that the trachea is not dislocated but is flattened from before backward as shown in Figure 10.

Dilatation of the superficial thoracic veins over the upper chest wall is common in intrathoracic

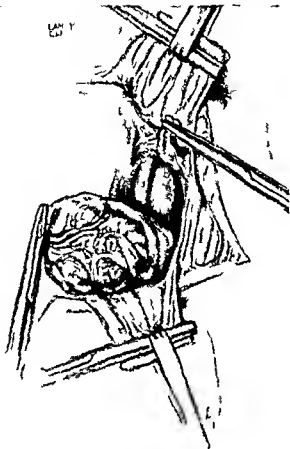


Fig. 14. Showing how the goiter may be turned forward after the ligation of the superior thyroid vessels thus exposing the great vessels and the natural line of approach along the sheath of these vessels in which place the finger can readily be inserted into the mediastinum.

goiter and is due most probably to the fact that the intrathoracic extension presses upon and obstructs one or both internal jugular veins thus causing compensatory dilatation of the superficial venous system (Figs. 11 and 12).

Dullness over the upper thorax may often be demonstrated in intrathoracic goiter but when present the intrathoracic tumor is so definite that it can readily be demonstrated by the X-ray.

We believe that in a great majority of cases intrathoracic goiter could be prevented. Every patient who has a low lying adenoma of the thyroid which has a tendency to descend into the thorax should have the growth removed before it becomes intrathoracic. In every patient in whom the inferior limit of either pole of the thyroid can not be palpated as it extends below the clavicle and is therefore not demonstrable the goiter should be considered as becoming intrathoracic.

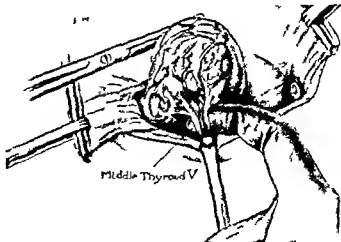


Fig. 15. Showing how as the finger is inserted downward toward the mediastinum along the great vessels it can be hooked up to catch the middle thyroid veins as they pass from the internal jugular into the upper part of the intrathoracic goiter. These should be cut and ligated at this point to prevent tearing of the veins in delivery of the mass and consequent profuse venous bleeding.

and that lobe of the thyroid should be removed. All patients who have multiple adenomatous goiters which are at all low in location should be examined once every year or once every two years to be certain that the low adenomatous portion of the thyroid is not becoming intrathoracic.

The removal of intrathoracic goiters can be very simple or quite difficult. A valuable technical contribution to the removal of intrathoracic goiters is that suggested by Dr. J. deB. Pemberton of Rochester, Minnesota, and consists of the ligation and severing of the superior thyroid artery and vein as a first step in the removal of the intrathoracic mass (Fig. 13). All the blood supply of an intrathoracic goiter fortunately descends from above downward with the descent of the goiter—the superior and inferior thyroid arteries and the superior middle and inferior thyroid veins. Ligation and severing of the superior vascular thyroid pole permits mobilization of the upper portion of the tumor so that its pole may be turned forward thus exposing the back wall of the thyroid and the point where the great vessels are in contact with it (Fig. 14).

One of the most important technical points regarding the removal of an intrathoracic goiter is that it should if possible be removed intact since fragments left behind will be without blood supply, become necrotic, and so predispose to infection and mediastinitis. Attempts to pull intrathoracic goiters out of the mediastinum by traction from above will usually be unsuccessful because they are large in proportion to the thoracic aperture they must pass through and



Fig. 6. Shows how the finger may be inserted into the mediastinum from below and swept laterally about the tumor to free it from the condensed layer of connective tissue which surrounds it and to pry the growth out by pressure from below upward.

because they are held in place within the mediastinum by a certain amount of negative pressure. Attempts to pull the tumor out from above by grasping it with double books usually result in the double hooks pulling out the tumor becoming torn and a dangerous amount of bleeding brought about.

The most certain way of delivering an intrathoracic garter is to insert a finger into the mediastinum, sweep the finger about the tumor in order to free it from the condensed layer of connective tissue which surrounds it and to pry the growth out by pressure from below upward.

After the superior thyroid pole has been ligated and cut and the upper pole of the tumor has been turned forward a slight amount of traction upward brings into view the middle thyroid vein or veins running from the internal jugular to the tumor (Fig. 15). With these veins ligated and cut the finger may then readily be passed down into the mediastinum. It is much easier and much safer in cases of intrathoracic garter to pass the finger into the mediastinum from the rear than along the front of the tumor below the level of

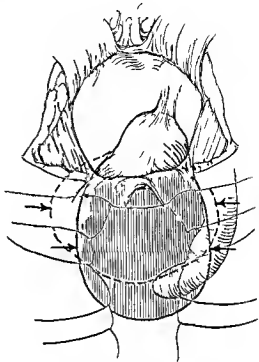


Fig. 7. The hand enters the thoracic cavity through the upper thoracic petre. The blade is loaded by a double book. The diagrammatically shows the finger is maintained within the definite surrounding layer of condensed connective tissue about the tumor. No injury will be done to the pleura and thoracic duct.

the middle thyroid veins there are no veins on the posterior aspect of the tumor to be torn off and there is always a distinct line of cleavage along which the finger may be passed between the tumor and the internal jugular vein and the common carotid artery in their sheaths (Fig. 15). This is an extremely important point in the technical management of intrathoracic garters.

With the finger in the mediastinum as shown in Figure 16 the tumor may be separated from its surrounding structures digitally and as long as the finger is maintained within the definite surrounding layer of condensed connective tissue about the tumor no injury will be done to the pleura and thoracic duct.

With the finger below the intrathoracic garter the tumor may usually be gently popped out of the mediastinum. Occasionally pressure on the bottom of the tumor apparently so widens its diameter (Fig. 17) that it will not pass through the superior thoracic strait. In such cases we have been successful in removing the intrathoracic tumor by grasping its top with two or three double books and by lifting gently upward upon the tumor at the same time that pressure is made from below with the finger in the mediastinum.

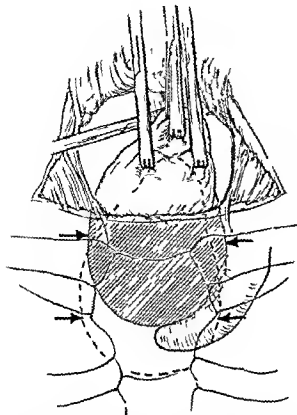


Fig. 18 Illustrates the plan of upward traction on the intrathoracic goiter by means of double hooks at the same time that upward pressure is made from below by the intrathoracic finger overcoming thus the tendency of the tumor to widen and wedge at the thoracic aperture. Thus we believe is a most important contribution to the plan of delivery of intrathoracic goiters. Its employment will make possible delivery of intrathoracic goiters which would otherwise require splitting of the sternum.

(Fig. 18) The traction from above overcomes the tendency of the tumor to widen itself and wedge in the thorax from pressure from below. Pressure from below and traction from above must be gentle and gradual if one wishes to be successful in the delivery of large intrathoracic goiters.

This is a most valuable maneuver in the successful removal of large intrathoracic goiters. It has made possible in our experience the delivery of some intrathoracic adenomata that would otherwise necessitate splitting of the sternum.

During the period when the intrathoracic mass is being delivered from the thorax the patient will often not be able by his own efforts to get sufficient air into the lungs because of the pressure of the large tumor upon the trachea during its gradual delivery through the thoracic strait. In such cases if nitrous oxide gas is used as the anesthetic our anesthetists have generally succeeded in keeping the patients supplied with oxygen by using a tightly fitting face mask and by

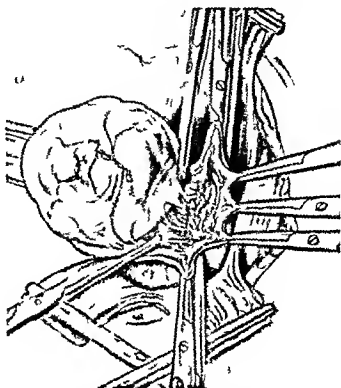


Fig. 19 This illustration demonstrates the method of excising a discrete adenoma of the thyroid from its surrounding shell of thyroid tissue after the adenoma has been delivered from the mediastinum. Note that a shell of thyroid tissue remains behind over the region of the parathyroid and laryngeal nerve to protect these two structures. This shell of tissue can later be sutured together to restore the defect in the remnant of thyroid tissue.

pressing upon the gas filled bag. If the degree of tracheal obstruction is considerable then before removal of the intrathoracic mass a stiff walled intratracheal catheter should be passed between the cords into the trachea by the laryngologist or anesthetist so that the danger of suffocation during delivery of the tumor is overcome.

In our experience in removing intrathoracic goiters ligation of the inferior thyroid artery has rarely been necessary since the artery is elongated by the gradual descent of the tumor. This permits the delivery of the tumor without danger to its more or less pedicle like inferior blood supply and the removal of the adenoma by preserving its posterior shell of thyroid tissue together with its blood supply (Fig. 19) as we described in *Annals of Surgery*¹ provides a plan which insures preservation of the lower parathyroid and recurrent laryngeal nerve on that side.

As soon as the intrathoracic mass is delivered a large warm moist strip is packed into the cavity in the mediastinum from which the goiter has

been delivered and the strip is allowed to remain there until the blood supply of the delivered goiter has been ligated and the goiter has been removed. The pack is then removed, long bladed retractors are inserted and with good exposure the cavity is carefully inspected with a good light so that any oozing veins may be seen, snapped and ligated. It is quite important to control any oozing veins since the accumulation of a hæmatoma within the mediastinum predisposes to infection and mediastinitis. With the cavity dry and well exposed as it is on each inspiratory movement a large dry strip is lightly packed into the cavity until it is completely filled. This step of the operation is a very necessary one in our opinion. It controls any overlooked oozing into the cavity and produces protective walling off granulations within the mediastinum, a measure which has in our opinion saved more than one of our patients operated upon for intrathoracic goiter when secondary accumulation of infected serum has occurred in the mediastinal cavity late after removal of the drain.

We wish particularly to warn against this last mentioned complication. Several times in the past we have removed the intrathoracic pack on

the fourth or fifth day, replaced it with a piece of rubber dam for 5 to 6 days and then removed the rubber dam on the tenth to twelfth postoperative day. Later the uncollapsed mediastinal cavity has filled up with serum and become distended to such an extent that when the mediastinal cavity was reopened the fluid within it squirted out for a considerable height, showing the degree of tension it was under. It is here that the protective mediastinal granulations produced by the gauze pack undoubtedly saved these patients' lives. This experience demonstrates to our minds how necessary it is to pack the mediastinal cavity and how necessary it is to keep it open with gauze or cigarette drains for between 2 and 3 weeks until they have completely collapsed and filled up from the bottom so that serum cannot reaccumulate in them.

SUMMARY AND CONCLUSIONS

Patients with low lying adenomata of the thyroid should be kept under yearly observation. Should the adenomata show downward progress they should be removed. Technical methods for the removal of intrathoracic goiters and the care of the resulting mediastinal cavity are suggested.

FROM THE ORTHOPEDIC SERVICE OF THE STATE UNIVERSITY OF IOWA

A MODIFICATION OF THE ROTATION ARTHRODESIS OF THE KNEE
(ROEREN)

J F MILGRAM MS MD Iowa City Iowa

F m th D p m t f O th p d i c S g j S e f Dr A th St dl St t U ty f l M d 1 5 ch 1

THE knee joint is endowed with free motion which is obtained by virtue of the incongruence of its articular surfaces. This asset becomes an obstacle to fusing the knee. To obtain bony approximation various methods have been devised. The methods of Hibbs and of Galloway, with various modifications are most widely employed. In each there is painstaking removal of the articular surfaces with or without bridging grafts.

In June 1929 Roeren described a new and most ingenious principle for obtaining bony ankylosis of a knee or ankle joint which in his hands required only 4 to 5 minutes as it did not require resection of the articular surfaces. Expressed in its nearest English equivalent he termed it rotation stiffening. It consisted of producing a cylinder of bone half of which would be derived from each articular surface and rotating the two segments 90 degrees. The erstwhile joint space of the knee for example now became vertical instead of horizontal. The joint was bridged by two massive bone grafts like the tumblers in a lock to use an inadequate comparison (Figs 4 5 6).

This cylinder is produced by Roeren with the aid of a large circular chisel consisting of two halves held in a sleeve. Between the two is a flat bar which does not project beyond the end of the chisel and which serves only to rotate the fragments *in situ*. The chisel is driven into bone if possible as far as the posterior capsule and then rotated 90 degrees after which the tool is withdrawn in parts.

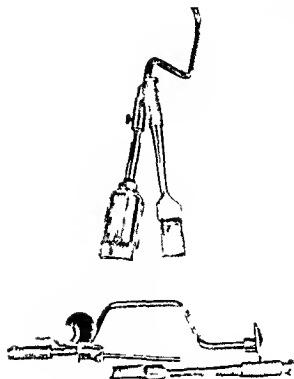
Several difficulties are encountered in performing this operation in the knee of the cadaver. The first difficulty constitutes the major drawback to this technique. There is very real danger of cutting through the posterior capsule into the popliteal vessels and nerves with the unguarded chisel. The operator in an excess of justifiable caution will remove too short a cylinder in his wish not to drive his chisel too deeply and make the resultant fusion dubious. The two condyles particularly the lateral project considerably more posteriorly than the curving plane of the femur. Even though the lower arc of the chisel may be still engaged in bone the upper arc of the cutting

edge may be already in contact with the popliteal structures the injury of which is irreparable or the lower arc may have penetrated the tibial cortex. The latter is unfortunate since the vital structures lie close to the posterior aspect of the tibia.

Secondly, it is not easy to drive a circular chisel as large as required for an adult through tibial and femoral condyles and to produce the mechanically perfect cylinder of bone necessary for ease of rotation of the fragments and accurate coaptation after rotation. Inspection of the depth to which the cutting edge has penetrated is desirable but necessitates withdrawal of the chisel in parts and this is a difficult procedure without fracturing the grafts off short.

The third difficulty arises from the fact that the fragments are rotated *in situ* with the crucial ligaments still intact. It is found as Roeren observes that there is a tendency for the segments of the cylinder to rotate. These powerful fibrous cords tend to bring the fragments back into original alignment and may nullify the procedure.

An attempt has been made to overcome these objections in technique since the principle Roeren employed in fusion appeared logical and desirable. A means was sought to cut with ease a smooth cylinder and most important of all an instrument was designed which was equipped with a fool proof guard against cutting into the danger zone of the knee. The instrument is shown in Figures 1 2 and 3 which are self explanatory. The cutting tool is a rotating cylindrical cup of thin crucible steel $1\frac{3}{4}$ inch in diameter. The handle of this instrument contains a well into which fits accurately a cylindrical post $\frac{3}{4}$ inch in diameter. This post bears a thin malleable transverse plate of monel metal which can be curved at the operation so as to slip between the articular surfaces and rest against the posterior crucial ligament after severance of the anterior crucial ligament. Of major import is the fact that the post is of such length compared to the well that it projects $\frac{1}{2}$ inch beyond the cutting teeth of the circular saw. Thus when the tool has been sunk maximally there will still be sufficient clearance to insure safety, the saw not being able to approach the



I r b C l w w t h p t d g b f f t y
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h l r d t c f s a w f m n g t h e g r a f t
l g C c l s a w p o s t m d b t d c h l r d
f t h w l t h b o f t h e s w b l

capsule because of the projecting plate of the post. The necessary margin of safety was determined by measurements of the knee joints of twelve male and twelve female cadavers of different sizes. Necessary protrusion of the post beyond the cutting edge for an adult knee was surprisingly uniform. With the post resting against the posterior crucial ligament $\frac{3}{8}$ inch protrusion was found to meet the requirement (Fig 1). The saw cut rapidly and smoothly with a hand brace and bit after it had been slipped over the post. The post fixed in the joint space permitted the saw to be started easily and prevented it from jumping about. A motor driven tool was not tried as so large a circular saw would not appear to be easily controllable at high speed.

To free the semicylindrical grafts at their posterior ends after withdrawal of the circular saw a stout but thin chisel was curved to the arc of the saw blade. This was inserted into the cut and by leverage the grafts were broken loose at their posterior end. To avoid spontaneous re rotation of the grafts the soft tissues attached to them were carefully divided with a curved scissors. The



Fig 3 L t l w o f k e f l d s d g e C d e
S w g g d P t l l b l s p e l y e t r t e d f p

grafts fitted in pretty fashion inasmuch as they were accurately cut segments of a cylinder.

The steps of the operation employing this technique are as follows:

- 1 A shallow U shaped skin incision is made and skin towels are applied. The curved incision is carried directly down to the joint the lowest portion of the incision paralleling the crest of the tibia. The patella and severed ligamentum patellae and capsule are reflected in the flap.

- 2 The anterior edge of the tibia is exposed for 1 inch by subperiosteal stripping.

- 3 The knee joint is placed in any desired amount of flexion.

- 4 The anterior crucial ligament is divided with a scissors.

- 5 The malleable wings of the post are inserted into the joint cleft bending the wings of monel metal with two pliers if necessary. The post is driven in with a mallet until it is seen to rest against the intact posterior crucial ligament. An assistant forces the tibia against the femur in the desired amount of knee flexion. A sand bag behind the knee permits the heel to rest on the table (Fig 4).

- 6 The cutting tool is slid on so that the well engages the projecting post. The cylinder of bone is then easily cut. It is unwise to try to rotate the brace handle round and round. Instead the hand on the brace should travel 90 degrees up and back.

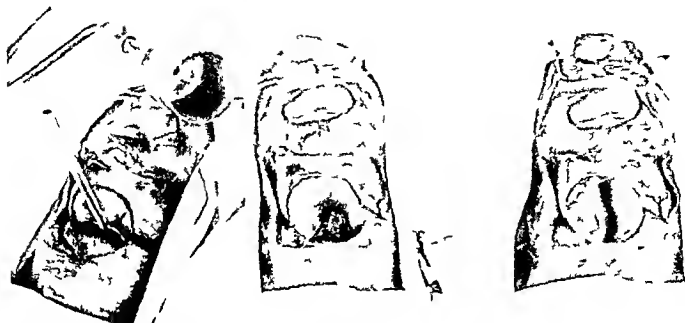


Fig 4

Fig 5

Fig 6

Fig 4 Saw removed. Post remains *in situ*. Grafts still attached posteriorly preparatory to removal with curved chisel. Patella visible in superiorly retracted flap.

Fig 5 Graft removed lying at right inferiorly.
Fig 6 Grafts replaced rotated into vertical position preparatory to closure of capsule and skin.

10 from twelve to three o'clock back to twelve etc. The saw may be sunk to the maximum. It is then rapidly withdrawn by rotation. The depth of the hole is inspected and if desired may be safely deepened a trifle by driving the post in deeper. The post is then also withdrawn.

7 The semicylindrical chisel is now inserted deeply into each half of the circular cut and the posterior ends are fractured free. Slight increase of knee flexion if possible will be of some assistance in this step.

8 With a curved scissors the soft tissue attachments are divided to the posterior ends of the grafts.

9 The two grafts are removed and replaced so that the erstwhile joint space now runs up and down. The anterior edges of the grafts are tapped to drive them in fully (Fig 6).

10 The tourniquet is removed and the anterior capsule and skin are approximated in layers.

11 A long leg plaster cast is applied with minimum padding. If desired the cartilage of the contiguous articular surfaces of the lateral condyles which are in contact may be removed with a few blows of the straight chisel without increasing materially the operative time.

Since the patella is usually too high to bridge the knee joint, there is not much gained by de-

nuding its articulation of cartilage unless it is felt that persistent movement of it by muscle contractions may produce pain even if the tibio femoral articulation is fused. In that case its cartilage and the adjacent femoral cartilage had best be removed.

FEATURES OF THE OPERATION

- 1 The operation is done with ease and speed. It can be easily completed in 10 or 12 minutes.
- 2 The bone grafts are massive and in accurate contact with cancellous bone of femur and tibia over a very large area not only above and below but behind the grafts. The conditions for early osseous union are most favorable.
- 3 The operation necessitates minimal manipulation and shock in aged patients.
- 4 There is no shortening except for that resulting from the amount of flexion at the knee. Since the cylinder is massive and of course fits the corresponding hole exactly in any degree of flexion in which it has been excised, any position of flexion or extension may be used. The contours of the knee are not disturbed.
- 5 The lateral ligaments are left intact. Consequently lateral alignment and stability are assured during the 8 to 12 weeks period of plaster fixation. A long leg cast is quite sufficient to con-



Fig 7



Fig 8



Fig 9



Fig 10

Fig 7 AP view of the knee joint showing a large, dark, irregular mass on the medial side. Fig 8 Lateral view of the knee joint showing a large, dark, irregular mass on the medial side. Fig 9 Lateral view of the knee joint showing a large, dark, irregular mass on the medial side. Fig 10 Full-length view of the patient showing the lower extremities and the position of the knees.

Fig 9 Lateral view of the knee joint showing a large, dark, irregular mass on the medial side. Fig 10 Full-length view of the patient showing the lower extremities and the position of the knees.

control the degree of flexion. The hip spica so annoying to adults and potentially dangerous to the aged is dispensed with.

6. If an arthroplasty may be considered later in life the least damage has been performed.

INDICATIONS FOR THE OPERATION

1. Arthritic knees unrelieved by conservative treatment in patients who have been relegated to joint fusion to relieve pain.

2. Synovial tuberculosis wherein no gross destruction of the femur or tibia is apparent. The placing of free grafts in the presence of gross osseous tuberculosis while possible is certainly not wise.

3. Paralytic knees in adults.

4. Paralytic knees in children wherein the X-ray plate demonstrates that there is sufficient breadth of the tibial epiphysis to permit the excision of a sufficiently large cylinder without injuring the physeal line. Roeren emphasizes this feature particularly.

CONTRA INDICATIONS

1. Deformity of the knee which requires excision of bone to obtain a position suitable for fusion. The rotation arthrodesis can however be combined with a wedge resection.

Pathology which would preclude the use of bone grafting.

3. Knees in children which would fall afoul of the remarks in 4 under Indications.

Roeren has applied the rotation arthrodesis to the ankle also. It would appear that in the wrist and sacro iliac joints the operation would also be indicated. The size of the cutting tool, the length of the post, and the shape and character of the tip of the post could be altered to fit the special situation. Thus in the case of the sacro iliac joint the tip of the post would have to be pointed in order to permit the circular saw to be started. The success of this principle in fusing the knee has been demonstrated by Roeren.

The following abridged case report concerns a patient aged 59 years operated on with the modified technique outlined in this communication.

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90 degrees with but little force. Motion so obtained persisted to February, 1927, when the knee again had become stiff in extension. Foci of infection were sought and treated; braces and casts were applied and physiotherapy was used but none afforded her relief from pain in walking. Since 1921 the patient had been obliged to use both brace and crutches. Consequently it seemed that knee fusion was indicated and the operation was performed December 16, 1929, by the technique described. Fifteen minutes was required from incision to completion of skin closure, the operation being performed deliberately. The patient's knee had long been in extension and she desired fusion in this position. The postoperative course was uneventful. Sutures were removed the tenth day. The long leg plaster cast was worn for 12 weeks. Upon its removal fusion was solid clinically and roentgenologically (Fig. 7 to 10). The knee was now painless; patient could walk without pain.

Later course: Opposite knee became painful; patient is now being treated for arthritis of this member. The right knee has remained painless and rigid since operation.

SUMMARY

A modification of the rotation arthrodesis is described as applied to the knee joint. It is designed to afford safety, ease, and accuracy of osseous alignment in the performance of a fusion, the ingenious principle of which has been introduced by Roeren.

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CARCINOMA OF BOTH KIDNEYS

REPORT OF A CASE WITH REVIEW OF THE LITERATURE ON MULTIPLE PRIMARY MALIGNANT TUMORS¹

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F. M. U. I. g. I. Se. f. t. Al. H. p. t. Al. Cl. I. d. Ol.

THE occurrence of carcinoma in both kidneys is sufficiently rare to make worth while a report of the following case and to attempt to determine if possible whether or not each growth was a primary tumor

Th p t t a man of 56 y w dm t t d to the h p t l J ry 93 w h t y f h e m t p s t p d a d g e t l o s o f w e i g h t d s t e g h t w m o t h p u s l y h d f r s t t e e d b l o d i t h e u d h a d p s e d y g a m t s e c h d y c t h t t m e

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Th p t h o l g t e p i d t h e l f t k i d y w a g e t l y n l g d d w s l m s t c m p l t l y o c c u p i e d

Fig C ma f both kid ey

R d b e f h A m A s e I G t U y S u r g e o n F h L k i d M y j d 4 9 3





Fig. Right kidney—transitional cell carcinoma



Fig. 3 Left kidney—transitional cell carcinoma

except for a small amount of kidney substance in the lower pole by a large tumor mass which was soft in consistency and of a yellowish gray appearance. On section there was found marked softening and scattered areas of hemorrhage and necrosis. Microscopical section revealed the presence of tumor cells arranged predominately in a papillary formation. In other areas the structure of the tumor resembled that found in the right kidney.

Diagnosis: transitional cell carcinomata of the left kidney.

With these findings it became of interest to attempt to determine whether the two carcinomata were independent primary growths or one a metastasis from the other. On the subject of multiple primary malignant tumors the literature is extensive but confusing as there are so many different classifications used. Billroth in 1889 set forth three conditions which must be present to justify the diagnosis of multiple primary malignancy: (1) that the tumors must differ histologically; (2) that they must have different points of origin; and (3) that each must produce its own typical metastasis. These requirements are no longer accepted as necessary and Major states that it is at present a well established fact that multiple primary malignancy may arise in any of the following ways:

- Multiple identical tumors
 - in the same organ
 - in the same system of organs
 - in various organs

- Different types of tumors
 - in the same system of organs
 - in various organs

The multiple origin of carcinoma is also well proved and Wooley believes that these cases do not represent an extension of one original focus through a tissue or organ or system but the independent development of new growths of like histological character at separate points and thus presumably under the influence of a common stimulus. He says further that the analogy of multiple benign growths makes the theory of multiple malignant growths tenable without invoking metastases. The greater rapidity of development of malignant growths and the relatively early death of those affected tends to make more marked the difference in size between the first and subsequent primary growths and so leads to the assumption of metastasis. Ewing believes that the rather common occurrence of two or more tumors in different or the same organs of the same subject suggests nothing more than the accidental coincidence in several organs of the general biological factors in the genesis of tumors. Reasoning along the same line, Fuhr concludes that multiplicity of tumors is common enough to indicate a definite tumor diathesis in certain patients. We shall be able to understand better the relation multiple primary malignant tumors of the kidney bear to the picture of multiple primary malignancies in general if we divide these cases arbitrarily into three classes:

- I. Multiple primary malignant tumors in general including the different forms of malignant tumors and the various organs and tissues in



Fig. 4. Carcinoma of right kidney showing irregular islands with only slight difference in cellular reaction. $\times 100$.

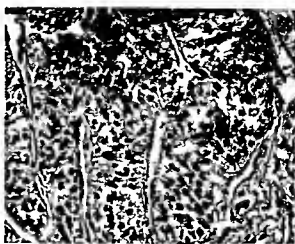


Fig. 5. Carcinoma of right kidney showing irregular islands of tumor cells with minimal spindle formation. $\times 175$.

which they occur represent of course the largest class. In these cases Orr employs the term multiple malignant neoplasms to signify the occurrence of two or more essentially different primary malignant tumors in the same individual and multicentric tumors for those in which the same growth appears more or less simultaneously in several places.

In a study of the frequency of multiple malignant neoplasms Orr found that over a period of 36 years 7207 autopsies showed 1046 cases of malignant disease among which were 8 cases of multiple malignant tumors—less than 1 per cent. He believes that there is no etiological relationship between such tumors and that they occur purely as the result of coincidence. The sixth decade of life furnished the greatest number of cases.

Multiple primary carcinomata in various organs are not uncommon. Siehke has collected 53 well established cases from the literature and adds 2 of his own. None of these involved both kidneys. Since these cases most frequently occur in patients of advanced age Siehke believes that they are due to the lessened resistance of old age when an unusual opportunity for growth is presented to nuclei of embryonic tissue. He has further noticed that the tax on body resistance is less from one focus of carcinoma with its metastases than from two primary carcinomata. These latter patients die so quickly that often no metastases are found and their course is so rapid that they are rarely diagnosed ante mortem. Over a period of 35 years Junghans found that in 36,408 autopsies there were 4192 cases of

carcinoma of which 19 were multiple: 11 in men and 8 in women. None of these cases were double carcinoma of the kidneys.

2. *Bilateral primary malignant renal tumors* include sarcoma nephroma and carcinoma. Statistics of their relative frequency vary widely and are confusing. Ewing states that papillary adenocarcinoma is the most frequent of renal growths and that many of them are incorrectly recorded in the literature as hypernephromata. In the reports of other observers sarcoma occurs more frequently than carcinoma. A further cause of confusion is the fact that cases of renal sarcoma of the small round cell type associated with round cell infiltration in glands, marrow, spleen and liver are reported by certain writers as primary kidney tumors while other authors on account of the associated blood changes believe them to be manifestations of systemic infection of a leukæmic or lymphosarcomatous type.

Paul states that bilateral primary renal malignancy is more common in children than adults and that 50 per cent of all malignant kidney tumors in children are bilateral. Jacoby found 8 bilateral cases in 41 renal sarcomata. Kuester in 607 cases of renal malignancy reports 13 primary bilateral growths. Nicolich gathered from the literature 19 cases of apparently primary bilateral malignant renal tumors. In 18 of these sarcoma was present on one or both sides. There was no instance of bilateral carcinoma. Kapsammer in 69 cases of renal tumors found 3 primary bilateral instances. Certain authors believe the involvement of the second kidney is usually a metastasis and that it is difficult to tell whether



Fig. 6 Carcinoma of left kidney showing definite papilliform arrangement $\times 10$



Fig. 7 Metastatic nodule of undifferentiated carcinoma in right kidney $\times 85$

the lesion in the second kidney is primary or metastatic unless the tumors of the two sides present a strongly different pathological character. This argument is weakened by the well known differences which often occur between the parent lesion and its metastases. Kuester states that metastases from malignant kidney lesions take place in the following order of frequency: lungs, liver, glands, bone, and much less often the other kidney.

3. *Bilateral primary renal carcinomata* represent the rarest form of bilateral kidney tumors according to Siebke they occur in less than 1/100 of 1 per cent of all autopsies. Escalier reports 1 case, Steffen 2 cases, Lubarsch 1 case. A few other bilateral cases of renal carcinoma are on record, but the lesion in the second kidney was regarded as a metastasis from the first.

Metastases in renal carcinoma take place by the blood as well as by the lymph stream owing to the tendency of renal tumors to grow into blood vessels. The lung is most often affected with liver, gland, bone, adrenals, renal vein and cava coming next in order. Lubarsch states that in distinction to all other cancers renal carcinoma metastasizes to the lung through the blood stream and he has never found the peribronchial glands affected. In true bilateral primary cases however metastases may be absent as the course of the disease is so rapid. The symptoms in these rare cases may be atypical and the fact that a double lesion is present may not be diagnosed before the autopsy.

In the present case it is of course impossible to prove that the lesions in each kidney were primary in the absence of a complete autopsy.

The two kidneys however presented an entirely different macroscopical picture. On the left side the upper two-thirds of the organ were completely taken up by a compact rounded mass of cancer tissue while on the right side lumpy nodules were scattered throughout the organ. Microscopically the two lesions are identical although in each kidney two or more types of cancer are present and on the left side papilla formation is more marked.

H. T. Karsner, director of the Institute of Pathology of Western Reserve University who studied sections from both kidneys and to whom I am indebted for the photomicrographs says: "The photographs are arranged to show (Fig. 4) the cancer in its undifferentiated form where it might be called a carcinoma simplex (Fig. 5) the cancer in a form similar to that seen in the usual cancers of bladder and renal pelvis and (Fig. 6) the cancer with definite papilla formation. Taking the mass in the left kidney as a whole the papilla formation implies shows a fairly high degree of differentiation and does not dominate the entire picture. It might be justified to peak of it as a papillary transitional cell carcinoma but I personally would prefer to refer to it as a transitional cell carcinoma. I have made a fourth picture (Fig. 7) of the carcinoma to show how it metastasizes through the kidney in small undifferentiated nodules."

X-ray plates of the lung were negative for metastases and in view of the known predilection of renal carcinoma to invade the lungs with two such advanced tumors it seems impossible for the process in one kidney to have been secondary to the other without finding metastases in the

lungs where they are more likely to occur sooner. The short clinical course of the disease (4½ months) and the absence of demonstrable metastases are in favor of a bilateral primary renal carcinoma.

SUMMARY

1 A case of carcinoma of both kidneys is reported.

2 The literature on multiple primary malignant tumors is reviewed.

3 In the case reported in the absence of a complete autopsy it is impossible to prove that each lesion was a primary tumor but conditions are pointed out that make such a theory tenable.

The following table shows the pathologic findings in the pathologic study of the case.

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- AL AR AN d Irb RT Les T m d R Pa s
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 DUSCH L U b p m M lt pluz t t on
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 3 FOLLI F U b M lt pl taet n G s hwa l st
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 4 ESCALIER S m m d 9 97
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- 7 JUNGHANN H E e K eb tatist c ueb 35 Jah
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 8 K FS MME Q ot d by Wag
 9 KUES ER Chr g de Nie 896 9 p 56
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 7 SEECO D P M lt pl primary m l gn nt eo pl m
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 8 SIE KE H Ueb m lt ple C n me Zt h f
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A MODIFIED TECHNIQUE FOR SPINAL FUSION

ALLANDEE GIBSON M.A. M.B. Ch.B. (Edin.) F.R.C.S. (Eng.) F.A.C.S. F.R.S.T. WINNIPEG CANADA

THE use of the bone graft in attempted fixation of the spine has now acquired a well established place. There have been numerous modifications of the original technique of splitting the spinous processes so as to secure a bed of raw bone in which the graft may be embedded. There are two groups of difficulties: first, adaption of the graft to a curved contour; second, accurate splitting of the spinous processes themselves.

Different individuals vary in the degree of development of the spinous processes, even in those cases in which the line of the vertebral column is approximately straight, the processes themselves may be thin, almost flexible and so shaped that when an osteotome is driven from the tip to the base it does not divide the process with accuracy.

Again in spreading the two parts of the process for reception of the graft, one of the portions may break off either at the base or at a thin portion of the wall. To keep the graft in position necessitates the drilling of the processes and the insertion of sutures of say kangaroo tendon. However, familiar one may be with the structure of the vertebral column, it is difficult or almost impossible

to gauge exactly the depth of the spinous process itself, hence the operator is placed between the Scylla of a groove that is too shallow and the Charybdis of penetrating to the extradural space or even farther.

For the past 3 or 4 years I have been employing in suitable cases a technique that has proved so simple and so satisfactory that it may be worth extended trial. By means of it one can place in position a massive graft—whether the spines be thick or thin—and the graft proves self retaining. In a typical case six vertebral spines are fused.

OPERATION

An X-ray is taken with some opaque material such as a strip of lead to identify exactly the spines of the vertebrae involved.

An incision is made exposing the spines, and the sides of the vertebral spines are cleared, an attempt being made to roll back with the soft parts on each side a layer of periosteum with a scraping of bone on its deep surface. The lamina is also made raw. The tips of the spines are not cleared. This leaves a button like expansion of the tip of the spine covered by a cushion of supraspinous ligament.

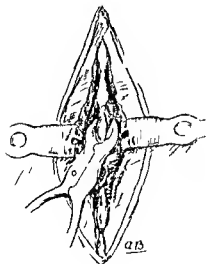


Fig. 1 Removing spines of affected vertebra

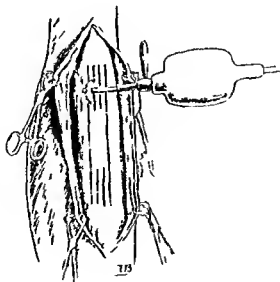


Fig. 2 Outlining the tubal graft



Fig. 3 Graft in place

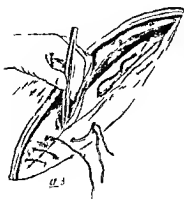


Fig 4

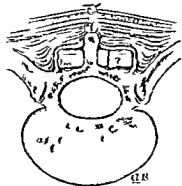


Fig 5

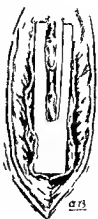


Fig 6

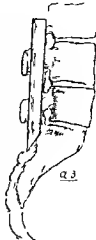


Fig 7

Fig 4 Cl e ly
Fig 5 D gramm t c to how g l t n f
a f t a w b d p o s t m

Fig 6 L mb c l graft
Fig 7 D g m sh w th l t r a l c w f g f t
p to

The spine of the vertebra involved is then amputated and with it the spine of the vertebra immediately above or immediately below. This procedure leaves a broad flat raw area which is deeply set. On it the main mass of the graft is placed.

The sides of the spines above and below are then made definitely raw, small bone chips being left in position.

The wound is packed with gauze and the skin edge approximated with towel clips. The next step is the cutting of the graft. The total length is that of the six prepared spines. The graft itself is removed from the subcutaneous surface of the tibia by means of the electric saw.

With a large blade four cuts are made parallel to one another. The two peripheral cuts go the whole length of the graft. The two inner cuts are interrupted so as to leave a space corresponding to the graft bed. The central cuts are fairly close together. A small blade is then fitted to the saw and cuts are made at each end so as to complete the separation of the graft. With the small blade also the base of the sliver is narrowed. The graft is removed from its bed, the sliver broken off from its base and set aside (Fig 2). We now have a graft with a double fish tail or clothes pin extremity. The groove at one end is made to slide along, the raw surfaces of the two upper spines tapped snugly into position by blows upon the free end. The unengaged fish tail has sufficient spring to glide over the cushioned spinous tips and to be held from springing up again by the

elasticity of the bone. To insure that the graft will fit snugly, the slivers are then tapped in between one limb of the fish tail and the spines one above and one below the body of the graft respectively. The amputated spinous processes are then denuded of ligamentous tissue, split and implanted one on either side of the body of the graft.

The soft parts are then replaced, tension being avoided. Interrupted silkworm gut sutures are used for the skin.

For 2 or 3 days the patient is kept lying in the prone or semi-prone position and is then placed on his back.

The cases in which this method has been employed have been of three groups:

1. *Tuberculosis*. For this it has been employed at various parts of the thoracic and lumbar spine.

2. *Crushing fractures*. These are mainly in the neighborhood of lower thoracic and upper lumbar region. They are common in industrial work and respond well to treatment by graft as above.

3. *Lumbosacral luxation*. When the lesion is in the lumbosacral region, e.g. in cases of luxation of fifth lumbar upon the sacrum or in spondylolisthesis where the displacement is rather severe, this method is readily applicable.

If the angle between fifth lumbar vertebra and back of sacrum is very acute, the graft is of the nature of a flying buttress. The upper end of the graft is fish tailed, the lower end is bevelled to fit as accurately as possible the raw area prepared on the dorsum of the sacrum. It is impor-

tant that no bony projection be left at the lower end of the graft. If such a prominence be present under the skin the patient complains of much discomfort when any object touches it.

ILLUSTRATIVE CASES

CASE 1 A. F. aged 47 years. Patient has been a guard at the penitentiary for 17 years. For 3 or 4 years past he has had severe pain in back since being dragged by a horse. He showed marked stiffness of lower lumbar region. X-ray examination showed distinct rotation of fifth lumbar vertebra on the sacrum. A second X-ray picture showed no apparent rotation. The discomfort would come on and pass off with a distinct feeling of slipping accompanied by an audible crack. A firm belt was made. As expected this proved of little value.

On December 6, 1928, a graft was placed to include the fourth and fifth lumbar spines and the back of the sacrum. He was kept in bed until January 20, 1929, was discharged to his home. January 22, 1929, reported in March as being free from pain and was last heard of at Christos, 1929, when he reported himself quite free from all discomfort. He has not lost a day since resuming duty as penitentiary guard at the beginning of April, 1929 (Fig. 8).

CASE 2 C. V. aged 30 years, painter. On June 24, 1929, patient fell from a roof, injuring the seventh thoracic vertebra. He complained of steady aching pain as if he had at all times a weight on the shoulders. X-ray examination showed a crushing fracture of seventh thoracic vertebra. On January 18, 1930, a double fish tail graft was done from the tibia. X-ray picture is shown in Figure 9.

CASE 3 E. D. female aged 23 years, complained of pain in the right thorax and right chest for about 1 year. The right breast was removed 1 year previously—tubercle was verified microscopically. X-ray examination revealed destruction of the body of the tenth thoracic vertebra—also a healed lesion between the fourth and fifth lumbar spines. On December 2, 1929, fish tail graft was done to include the ninth, tenth, eleventh spines (Figs. 10a and 10b).



Fig. 8 Roentgenogram of Case 1

CASE 4 W. H. male aged 37 years. Collapse of bodies of tenth and eleventh thoracic vertebrae, as noted. Wassermann react. on was negative. No lesions were found in the



Fig. 9 Roentgenograms of Case 2



A



A



A



B



B



B

Fig. 2. R. tg. gram of Ca 53. Fig. 3. R. tg. og. m. f. C. 54. Fig. 4. R. tg. gram of Ca 55.

l gs. A d bl fish tail graft w. applied n D m. y te d d t m b ca s f p n the l m b cal
 b 7 0 9 (F s d i b) \ ray p c t e g \ ray p c t s sho ed o b bo yl b t
 h w n F g u r e s a d b th p n d w l n e w l cal z d t t w s d
 Ca 5 M S W m l ged 4 y e r s W h e w k i n g c d d t m p l a n t b g r a f t Th w a d J r y
 b g w h c h w p r o p p d o t s d t t o p p l d e 4 9 3 9 g l e f i s h t a i l g f t b e i g s d (F g 2 n d
 a d p i n n e d h i m S i n e t h e n h e h b b l e t w k f b)

SUMMARY AND CONCLUSION

This method of using a bone graft for spinal lesions makes no claim for use in cases of pronounced kyphosis. It has been a matter of some surprise to discover to what an extent it was applicable even when kyphosis was present. The deep emplacement of the body of the graft allows a fair amount of curvature or angularity to be dealt with.

While the shape of the graft may appear rather complicated it is very simply fashioned and less

time is occupied than is necessary to drill holes and place sutures.

As regards firmness of fixation this is in my experience more complete at the time of operation than when sutures are used. Again sutures tend to soften and become absorbed. The lapse of time however makes the fixation in these cases still stronger. The method is mechanically sound, easy to apply and seems worthy of more extended use.

I desire to express my thanks to Dr. A. Blondal who made the drawings.

CORRECTION OF DEFORMITY AS A ROUTINE PROCEDURE BEFORE STABILIZATION OPERATIONS OF LOWER EXTREMITY

FAMIL HAUSER M.S. M.D. F.A.C.S. CHICAGO

THE treatment in the residual stage of an anterior poliomyelitis strives for the maximum amount of function with the minimum of deformity. When a joint is fixed the so called position of choice is one which gives the most usefulness and the best appearance. The position of choice has been fairly well established for most joints. With the knee fixed a few degrees of flexion adds considerable to the function of locomotion. An ankylosis of the ankle joint will permit the maximum usefulness with the foot slightly plantar flexed just enough to compensate for the heel of the shoe. The foot itself functions best when it is in the midposition neither deviating into valgus or varus nor lying in pronation or supination. Good function in the lower extremity demands stability. Muscular weakness gives rise to an instability so frequently seen in cases of residual anterior poliomyelitis. Until recent years braces have been the principal means used to obtain stability. The brace is an instrument applied to retain the position of choice. It is not the function of a brace to correct a deformity. The deformity can be corrected by means of surgery or manipulations and casts. A brace applied in the presence of a deformity gives rise to mechanical difficulties. Friction rub and pressure sores occur. The brace is strained and soon gives way so that it has to be repaired or replaced. Stabilization operations have been introduced to make the brace unnecessary.

When it is necessary to gain stability in the lower extremity and an operation is indicated the foot, knee or ankle whichever the case may

be must first be put in the position of choice. The most common method is to make the correction at the time of the arthrodesis. This can be done only with a sacrifice of tissue. Very frequently a muscular disbalance underlies the deformity and this is not removed by the operation. The tendency for a recurrence of the deformity remains and not infrequently manifests itself after the operation.

Residual anterior poliomyelitis is the most frequent cause of an instability in the lower extremity. The nature of the disease implies a loss of strength. The disease tends to have an asymmetrical involvement. Paresis occurs in one group of muscles while the opposing group remains normal. The normal group then contracts and the disbalance results in a deformity. If the paresis is extensive the general weakness results in a complete loss of function and the limb is totally without stability. To gain stability the limbs must be held in such a position that the body weight can be transmitted along the bony skeleton. At the knee for instance the quadriceps muscle becomes impaired. The weakness is soon noticed for the demand upon the quadriceps muscle is great. There is a tendency toward a flexion deformity. The first function of the quadriceps is to hold the limb straight at the knee so that the weight of the body can pass down the femur to the tibia. In full strength the quadriceps can lift the body weight as in climbing stairs or arising from a sitting position. With a paresis present the last two functions are soon lost but with a little strength especially if a

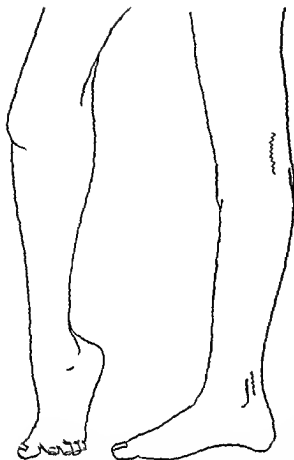


FIG. 1. Illustration of the functional deformity of the foot and ankle in genu recurvatum. The weight of the body comes through posterior to the midpoint in the joint. The posterior capsule with its ligaments was strong enough to withstand the extra strain and the patients stood and walked very well. This was further utilized by converting all fixed joints and even those which could be brought to 180 degrees into genu recurvata. Sometimes this was accomplished by cutting the tendons of the posterior group but more often by means of a supracondylar osteotomy. In other instances the now paralyzed flexors as a biceps or a semi-membranous or tendinous muscle was brought around and inserted into the patella. In this way the tendency for flexion was decreased and at the same time a power to bring the knee into recurvatum was created. All these methods have been performed with good results.

genu recurvatum exists the first function can be carried out. This enables the patient to stand and walk. If however a flexion deformity exists the full demand of strength is made upon the quadriceps with any attempt at weight bearing. Often the patient substitutes the loss of strength in the quadriceps by putting a hand on the thigh and in this way brings the strength of the upper extremity to carry out the function of the quadriceps. With these facts in mind several operations and procedures have been devised to correct the functional loss of the quadriceps at the knee joint.

First of all a brace can easily hold the limb in position. Obviously a brace that holds the limb straight has an advantage over one that has been applied with the limb flexed. An arrangement on the brace makes it possible to lock and unlock the joint at the knee permitting a change of position.

Next it was observed that frequently children were able to walk quite nicely with a quadriceps muscle practically lost when the knee was in genu recurvatum. The weight of the body came through posterior to the midpoint in the joint. The posterior capsule with its ligaments was strong enough to withstand the extra strain and the patients stood and walked very well. This was further utilized by converting all fixed joints and even those which could be brought to 180 degrees into genu recurvata. Sometimes this was accomplished by cutting the tendons of the posterior group but more often by means of a supracondylar osteotomy. In other instances the now paralyzed flexors as a biceps or a semi-membranous or tendinous muscle was brought around and inserted into the patella. In this way the tendency for flexion was decreased and at the same time a power to bring the knee into recurvatum was created. All these methods have been performed with good results.

More recently an arthrodesis of the knee joint on one side has been advocated in certain cases. Any one of these methods may vary the method of choice depending on the circumstances of the case.

An arthrodesis of the ankle leaves a very marked loss in function. The ankle joint is so constructed that practically all its motion is flexion and extension of the foot. There is normally no lateral motion present. Very seldom is there any instability that is due to an excessive play of motion at this joint.

Most instability occurs at the subastragaloid joint which permits varus and valgus. The astragalonavicular and also the calcaneocuboid joints are the seat of supination and inversion both of which make for instability when motion is possible in excess. At the same time the muscles are often disbalanced so as to cause deformities at these joints. The deformities in themselves account for some degree of instability.

Correction of the instability was formerly brought about by means of a brace which was applied with the foot in the midposition and with motion permitted at the ankle joint. In case the dorsiflexors of the foot were involved in a complete paralysis motion at the ankle was checked just below a right angle by means of an ankle catch. Where a deformity was present this was corrected by means of tenotomies, fasciotomies, manipulations and casts.

Then came the arthrodesis in which the subastragaloid, the astragalonavicular and the calcaneocuboid joints were fixed with the foot in the midposition. Often a deformity was present



Fig 3 Varus deformity of the foot Instability present in midtarsal region Medial view



Fig 4 Lateral view

An attempt was made to remove enough bone to bring the foot into the corrected position. These attempts not infrequently resulted in a shortened foot. Very often the deformity was not entirely corrected. Usually the disbalance that produced the deformity was still present and soon a recurrence of the deformity was in progress. When complete paralysis was present and no deformity the operation of arthrodesis of all three joints was sufficient in itself. In case a deformity is present however my experience would urge that deformity should be corrected routinely before the arthrodesis is performed.

Cases of residual anterior poliomyelitis where the operation is indicated are by choice over 12 years of age. By that time a disbalance may give rise to an outspoken deformity. It is true the use of braces often prevented the occurrence of a deformity. A deformity once present in an adolescent or in an adult is firm and fixed. It is not readily corrected by manual manipulation. The contractures are firm the fascia is short and thick, and the ligaments have contracted while the shortened tendons are powerful. Tenotomies and fasciotomies help remove these obstacles. The foot is then slowly forced into an overcorrected position. Very frequently tenotomies are not necessary. By means of the windlass arrangement and a special foot board as described in an article on the recalcitrant club foot in the *Journal of the American Medical Association* the cavus can be corrected. This is simply the method long employed by Professor Haglung. Then leverage with the board permits the foot to be twisted into the overcorrected position. A cast is worn with the new position held in place. The triple arthrodesis is then easily performed without any bony loss. Simple removal of the cartilage leaves the opposing surfaces denuded and in contact with each other. Where the disbalance of the muscles is

great this can be equalized by tendon transplants.

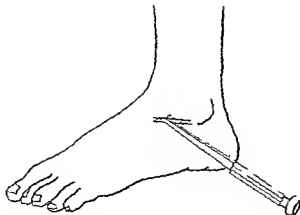
The appearance of the foot is very much better than in cases in which a mutilation has been permitted or in cases in which the correction is incomplete. Further the stability is greater. The weight bearing surface of the foot is more nearly normal. Then too the results remain better for the power of recurrence has been removed.

CASE 1. Correction of flexion at knee before the mid tarsal arthrodesis (residual anterior poliomyelitis). E. V. 23149 St. Luke's June 22, 1928. A child of 13 years came for correction of her limbs. She had a residual anterior poliomyelitis with an insufficiency at the right knee and was unable to gain full extension of the right knee as a result of contractures. At 4 years of age the patient was ill with headache fever and vomiting. This was followed by pain in the lower limbs. The limbs were paralyzed. The right limb was worse than the left. She made some recovery.

Several years ago she had a tendon transplant. Three years ago she had a tendon lengthened. From this time on she got about on braces. She walked with the knee slightly flexed and had to support the leg with her hand. She was advised that if the knee was in recurvatum she would have more stability and strength so entered the hospital for surgery. Her past history showed that she had osteomyelitis at 2 years of age and scarlet fever at 4 years.

The physical examination revealed an Italian child of about 13 years of age who walked with a limp and had a deformed right lower extremity. Her general examination revealed normal findings with the exception of the lower extremity. The right knee jerk was absent. There was a marked atrophy of the extensor group of the right thigh. The power was lost in the quadriceps. The flexors of the knee were very much impaired. The muscles of the right calf showed atrophy and some weakness. She was unable to do silex the foot. Plantar flexion of the foot was impaired. The foot was not deformed. She was unable to extend the knee past 165 degrees of flexion which meant a flexion deformity. Some contractures of the flexor muscles and also of the joint capsule.

Urinalysis showed straw color acid reaction 10 milligrams albumin no sugar and microscopically an occasional leucocyte a few epithelial cells and a few bacteria. There



F S n l s m l l on Fat r d j n t c t
p d o s t o m f l e l t d n d a t e u l r s f a o f
l e p h d t

16 o o o r v t h r o y t and g o o l u c t y t w i t h a
3 p n t h r m g l b
i t r l p p r a t n f t h g h t l w r h m l w d n t h e
g l t b l t h o p e t n T h u s u a l o d n e n d a l c o h o l
p p r a t o f t h e t h u g h k n a f i l e p r d d t h e p e
t o l n d t h n a s t h e a n i s o n w a m a d e o n t h e
l t l i d o n d o n h l f n h e s i o n j t b o e t h k n e
j t T h m u l s w p r a t d n d t h f m u w
p o s d k n i o n w m d e i n t o t h e p r i s t e u m b
t h d i T h p e o t u m l a t e d l a r g e F e l
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p o t m T h b o w a d i d e d w t h n o t e t o m T h
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b l c k l h F a f m a l i a g m t h a d p r o l y h e
l p p d f o w d t h d i s t a l s g m e t a d t h l e g w a
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d i e s p e n t T h e l m b s t h n p t i n t o l n m n t
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t m i t t h f o o t n t h r i g h t i d

T h a t w s p l t t h m u l i n n t h f r s t d y f
p e a t n T h i r l d d c l r a t o n s a d w e l l g w h h
w m n g n u n t h f t T h e p t c m p l a d f a
p l l p t n n t h b a k o f t h k n e e t h d d v
O n t h t h d y t h w a d w a s d i d T h r e w s e r o m
p e s e t l e t e w m e d o n t h 1 t h d a y t h d
w o u n d h l e d w t h o u t d f e l l y A f t r z w l s t h e p t i e n t
a s u p h l h i O t h e t w n t h d a y t h
c t a s h n e e d d t h e p t i t w a s d s m u c f t h f f
l w g d a y

T h p t i t w a s n n c r u t h e s a n o t p t t T h
c a t w g r a d u l l y d s c a d e f t e r 2 m o t h S h w l k e d
w t h t r u t h s d g r a d u l l y w l k e d w i t h o t n y a p
p o t S b c o u l d w a l k e r y w l l w i t h t h e u o f b r a c
w t h i n e a d e s t t h a n d t b i l y

T h t r i p l t i o d e s i f e f o t g a v e f t h r s t a b i l i t y
n d w a s c a r i d o u t n l y f i t e s h a n d g o o d w e f t h e
n e h t l u m b

This is a good example of re establishment of
stability and improvement of function in the
lower extremity by a simple correction of a de-
formity at the knee. This procedure obviously
increased the value of the arthrodesis to the pa-
tient and should be carried out routinely as a

preliminary operation wherever similar deformi-
ties exist

CASE C u l e f r m t y f i r s t c o r r e c t d t h e n a t r i p l e
a t h r o d e s i s (e s d u a l a n t e p o l i m y l i t u s) A s c h o o l b o y
o f 16 y a r c a m t o t h c l i c c o m p l a n i n g o f a n a h e i n t h e
l e f t f o o t B t h f e t w e d e f o r m e d t h e l e f t w o r s e t h a n t h e
r i g h t

W h n o m i f o l d t h e p a t n t h a d a n i n f a n t i l p a r a l y s i s
a n d h n r a l k e d w e l l H s r i g h t h e e l d i d n o t t o c h t h
g u n d w h e n h e s t o o d e c t o r w l k e d A y e a p r s t o
h e x a m i n e t h e f e l l d i n j u r e d l e f t f o o t A f t e r t h a t
t i m h e n o t c e d n n r a n t h c a v u d e f o r m i t y o f t h e
f o o t n d p a n n w i t h u s e T b l f i t l e g w a s b o t e r t h a n t h
p l t

I c e p t f o m e a d s d f i l e n z a a t 6 y e a r s o f a g e h a s
p t h t r y e g t i T h e p h y s i c a l e x a m i n a t i o n
a l e d a b o y 16 w t h s o m e p o s t r a t h c c h e s t c h a n s
A s l i t c a d c m u m u r w a p e s n t O t h e w s e t h c h i l d
w a n n m l w i t h t h c e p t i n f t h e l w e t r e m u l t s
T h l e f t i g w a n i n c h s h o r t e r t h n r i g h t T h w a s
c m p e n d e d f o r b y n e q u u d f o r m i t y f i t h n t h f o o t
T h l e f t f o o t w a s i n a l g u t h a k l e T h r e w a
d f i n t p c a v u p r e s e n t T h l e f t f o o t w a s m a i n l y
d f o r m d w i t h a n a d d i t o n l e q u u d f o r m i t y C e c t i
f t h l e f t f o o t t r t w a d e d

U n d r e t h a n a s t h e a t h p l a n t a r f a s c a w a s d i d e d
f r s t a t i t s i t m r t h o c a l c a n d t h n f a r t h
f r w a d T h f l e t d o w s t r o n g c i s n d r y
m u h s h e t d T h t e n t o m e w s e d b u t a n e o u s
t o d d t h e s e a l s o T h f o o t b o d w a s p l i e d a d t h
c a v u s b l a t e r i a t e d b y m e a n o f t h t w i s t e d b r a n d

A f t e a o r c t o f t h e f r m t y t h a r t h r o d e s i s w a s
c r i e d o u t T h f o o t w a s r y m c h i e t h d i l y t h e
c o c t u s o p a r a t i o n d t h e f a s f t h j u n t s i t b
A t h o s e s w r e r d i v a p p r o a c h d A f t h t d u s a
t o w h c h c s t o f d o l l e m r t h n t h r e m l o f t h e
a t l a g t h e r a f e s w e r e n e c e l l e n t a p p o i t o n

T h e p t n t m a d e a u n e t u f u l e c r y a d w a u p
f o r 10 d a y s T h w n d w a s m i t w i t h a r u m a t t h
f i r s t d r e n y b t w a s t r e l y h e l d a f t e r 5 d y s A f t e r
3 w e k a n t w a s a p p l e d n d t h p u n t w a s d
m u s d f r m t h o p a t l f l e w t h c a t w h h w a s
e p l c e d t w c f a p m o d f 3 m o n t h s T h c a s t w a s t h
e m e d a n d t h f t w a n m n g o o d p o t i o n a d t h e
p u t t w a s y m h p l a e d T h p a t s w s h d t
h a t h o t h f o o t r t e d a l s o

In this case a pes cavus resulted from infantile
paralysis. The usual procedure of a wedge
osteotomy shortened the foot. It further did not
gain complete stability, since the arthrodesis was
neither exact nor thorough. The correction of the
cavus deformity first was possible. It was further
practical and logical. By means of a compara-
tively simple procedure the deformity was ob-
literated and a normal arch with a lengthened foot
resulted. The arthrodesis of the subastragaloid
the astragalonavicular and the calcaneocuboid
joints could then be done in a classical manner

CASE 3 P d l p o l m y l i t s w i t h d f r m i t i e s f f o o t
n d k n e t l i p e e n o f f o o t a n d f l e x n f k n e e
C o r c t o n f o b o t h d e f r m i t i e s a i a r t h r o d e s o f t h e p d
t a n a l a w t h t h a u t h s t e c h n i q u e A y o g w m a
2 y r s f a m f e c t i n o f d o f o m d f o o t
w h c h c e d f t o l u m p d e c t i l y w a s t h s t f

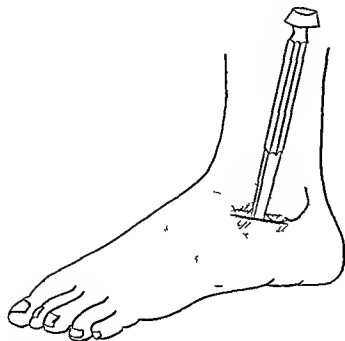


Fig 6 Osteotome in position for arthrodesis of calcaneocuboid joint

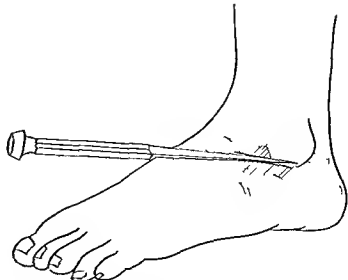


Fig 7 Osteotome in position for removal of cartilage of subastragalo joint

some pain. At 4 years of age she was said to have had infantile paralysis. Both lower extremities were involved. The left foot was more involved than the right. At first she believed improvement occurred. Ever since she could remember she had worn a brace for her left limb. At the time of the examination she wore a brace. Occasionally she attempted to walk without a brace and without shoes while at home. At times the foot seemed to give way and she would feel a sudden twist at the ankle. This had happened a week before she came for consultation. There was no swelling, but the pain persisted.

In her past history it was learned that she had been married at the age of 18 years. A child died of unknown cause and she had a miscarriage. The husband left her and she was divorced. She also had had an abdominal operation supposedly for appendicitis.

The physical examination revealed an obese woman who walked with a bad limp. The left limb was encased in a brace. There was marked atrophy of leg and the foot seemed flail. The entire limb was underdeveloped. There was no power in the muscles of the foot, but a little flexion was possible in the toes. The left knee was in a partially flexed position. The flexor group of muscles was contracted at the knee. The strength of the muscles at the hip was impaired. Motion was weakened but not limited. The left foot showed a marked talipes equinovarus deformity. There was marked cavus present. The foot was small and seemed very short. The patient walked on the outer side of the foot and the foot was very unstable. The right foot showed a slight cavus deformity with a contraction of the great toe present.

Correction of the deformity and operations for stabilization were advised. The patient was admitted to the hospital and 24-hour preliminary preparation was made on the left limb. Under general anesthesia the foot was manipulated. The board was placed against the plantar surface of the foot and with a piece of felt to protect the dorsum of the foot, by means of a semi-elastic tourniquet the foot was screwed down against the board. This process was repeated until the cavus began to give way slowly.

Then a tenotomy was used to divide the plantar fascia. The board was again applied and further correction of the cavus was gained. This was repeated at intervals between which the circulation was allowed to become reestablished. The board was again applied and by means of the first the varus and adduction were corrected and the foot was brought up into dorsiflexion. The fibers could be felt to give way as the force was applied and the foot was slowly manipulated to an overcorrected position.

Then under aseptic conditions the knee was prepared for operation. An incision 3 centimeters long was made just above the knee on the lateral side. An osteotomy was introduced and the femur was divided just above the condyles. After the fracture the distal fragment was rotated outward to bring the patella forward. The knee was bowed slightly backward correcting the flexion deformity and gaining a genu recurvatum. The limb was properly aligned. The foot was put into as much of the overcorrected position as could be retained with force. A plaster of Paris cast was applied from the toes to the umbilicus to retain the position. The patient was under the anesthetic for less than an hour.

On the twelfth day the wound was dressed and the sutures were removed. For 3 days the patient received morphine sulphate $\frac{1}{2}$ g. a day for relief of pain. The pain then subsided. The cast was changed after 6 weeks. The patient walked with the aid of crutches. There was union present at the site of the osteotomy. A cast was then applied from the toes to below the knee. Weight bearing was encouraged.

Three months after the first operation the patient returned to gain further stabilization of the foot. Under general anesthesia the foot was further corrected by means of manipulation. Then an incision one and one-half inches long was made obliquely below the external malleolus. The superficial fat lying in the space between the bones was dissected free. The bones were clearly exposed. The astragalonavicular joint was exposed and with a chisel the joint cartilage on both surfaces was soon removed. The subastragalo joint was next approached and an osteotomy was introduced so as to free the entire joint surface—first the lower then the upper. The freed cartilages were then extracted. The posterior margins were gone over with a curette to remove the last vestiges of the cartilage. Then the calcaneocuboid joint was obliterated.

THYROIDECTOMY FOR THYROTOXICOSIS IN THE YOUNG

REPORT OF TWENTY SIX CASES BETWEEN THE AGES OF EIGHT AND SIXTEEN YEARS¹

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CRYSTALLIZED opinion as to the treatment of thyrotoxicosis in children is lacking. With but two exceptions—the articles by Dinsmore who reported 48 cases from the Crile Clinic and Helmholz who reported 30 cases from the Mayo Clinic—the recent literature pertaining to the subject deals mainly with individual case reports and the methods of treatment are as numerous as the number of cases reported. Sattler however more than 20 years ago reported 184 cases, 53 per cent in a series of 3,477 cases collected from the literature to that time. Helmholz reported 30 cases, 0.9 per cent in a series of 3,432 patients of all ages who had exophthalmic goiter. This report is based on a study of 26 cases in which thyroidectomy had been done for thyrotoxicosis; the patients being children between the ages of 8 and 16 years. These 6 cases constitute 2.1 per cent of a consecutive series of 1,200 cases operated upon for hyperthyroidism.

In our series all the patients were subjected to operation and accurate data are available in 24 instances. There were 22 girls and 4 boys—in Helmholz's group there were 26 girls and 4 boys. The age distribution is noted in Table I.

TABLE I—AGE INCIDENCE

| Age | Cases | Age | Cases |
|-----|-------|-----|-------|
| 8 | 1 | 13 | 3 |
| 9 | 0 | 14 | 6 |
| 10 | 0 | 15 | 7 |
| 11 | 2 | 16 | 6 |
| 12 | 1 | | |

The duration of symptoms varied from 2 months to 3 years, the average duration being slightly more than 9 months.

The clinical manifestations of the disease in childhood correspond closely to those found in adults. The outstanding symptoms were tachycardia (9 per cent), nervousness (88 per cent), goiter (84 per cent), exophthalmos (80 per cent), tremor (70 per cent), weight loss (57 per cent), palpitation (30 per cent), left heart enlargement (27 per cent), irritability (23 per cent), weakness and restlessness (19 per cent). (Other less prominent symptoms are included in Table II.)

TABLE II—ORDER OF FREQUENCY OF SYMPTOMS

| | Cases | Per cent |
|----------------------------|-------|----------|
| 1 Tachycardia | 24 | 92 |
| 2 Nervousness | 23 | 88 |
| 3 Goiter | 22 | 84 |
| 4 Exophthalmos | 1 | 80.7 |
| 5 Tremor | 19 | 70 |
| 6 Weight loss | 15 | 57 |
| 7 Palpitation | 8 | 30 |
| 8 Left heart enlargement | 7 | 27 |
| 9 Irritability | 6 | 23 |
| 10 Weakness | 5 | 19 |
| 11 Restlessness | 5 | 19 |
| 12 Excessive appetite | 4 | 15 |
| 13 Amenorrhoea | 3 | 11 |
| 14 Excessive perspiration | 2 | 7 |
| 15 Dyspnoea | 2 | 7 |
| 16 Heat intolerance | 2 | 7 |
| 17 Right heart enlargement | 1 | 3.8 |
| 18 Stare | 1 | 3.8 |
| 19 Twitching | 1 | 3.8 |
| 20 Diarrhoea | 1 | 3.8 |
| 1 Nausea and vomiting | 1 | 3.8 |
| 22 Cholin | 1 | 3.8 |

The striking similarity of the symptoms in the young and in the older adults can be seen by comparing the symptoms of this group with those of an older group which we recently reported (4), the latter group comprising 200 patients over 50 years of age who were subjected to thyroidectomy for thyrotoxicosis. It will be noted from Table III that with one exception the ten most prominent symptoms in each group are almost identical.

TABLE III—COMPARISON OF OUTSTANDING THYROTOXIC SYMPTOMS IN CHILDREN AND IN ADULTS OVER 50 YEARS

| Child | P | t | Adults— 5 years & over | P | t |
|--------------------------|------|----|---------------------------|----|---|
| 1 Tachycardia | 92 | 1 | Weight loss | 84 | 5 |
| 2 Nervousness | 88 | 2 | Tachycardia | 73 | |
| 3 Goiter | 84 | 3 | Nervousness | 67 | 5 |
| 4 Exophthalmos | 80.7 | 4 | Tremor | 55 | 5 |
| 5 Tremor | 70 | 5 | Weakness | 43 | |
| 6 Weight loss | 57 | 6 | Left heart enlargement | 42 | 5 |
| 7 Palpitation | 30 | 7 | Palpitation | 41 | 5 |
| 8 Left heart enlargement | 27 | 8 | Irritability | 30 | |
| 9 Irritability | 23 | 9 | Exophthalmos | 29 | |
| 10 Weakness | 19 | 10 | Dyspnoea | 22 | |

In Helmholz's series of 30 cases tachycardia was observed in all thyroid enlargement and

nervousness occurred in 28 of the 30 cases. Emotional instability was the most marked feature. Exophthalmos was noted in 25 cases. Helmholtz lists the other more frequently occurring findings as follows: Bruit (70 per cent) hyperhidrosis (61 per cent) tremor (51 per cent) weight loss (53 per cent) polyphagia (50 per cent) quadriceps weakness (47 per cent) gastro-intestinal disturbances (41 per cent) and dyspnea (40 per cent).

Dinsmore mentions nervousness as the first symptom but does not state the number of cases in which it occurred. He reports tremor occurring in half of his 48 cases and weight loss in one third.

Little reference is made in the literature pertaining to blood pressure readings in juvenile hyperthyroidism. In this series we were able to obtain accurate readings in 13 cases. The average systolic pressure was 132 millimeters, the average diastolic reading 65 millimeters and average pulse pressure 6 millimeters. After operation the average systolic pressure was 108 millimeters, the diastolic 72 millimeters, the pulse pressure falling to 36 millimeters.

Weight loss occurred in 25 cases (51 per cent) of our series. The maximum decline was 31 pounds in 1 month, the average loss being 17 pounds. The average period of weight loss was 6 months. One patient gained 7 pounds in 3 months despite other signs of toxicity. Sixteen of Dinsmore's 48 patients exhibited decline in weight—1 child of 14 lost 0 pounds, 2 others of 13 years each lost 13 pounds.

In cases specific inciting factors were noted, namely: an attack of influenza, a tonsillectomy and the death of a brother. Dinsmore states that in only a few of his cases was there antecedent infection, 1 case each of pertussis, scarlet fever and dental sepsis and 2 cases of acute tonsillitis.

Six patients in this series were admitted to this service without having had any previous treatment. 18 children had had various forms of treatment without success. These included iodine (9 cases), thyroidectomies, tonsillectomy and radiotherapy (each 2 cases) and bed rest, forced feeding, injections into the gland, iodine and thyroid extract (each 1 case).

We have been able to obtain accurate basal metabolic rate determinations in 25 of the 26 cases comprising this series. Sixty-five preoperative metabolic rates were determined for the 25 patients—an average of 2.6 rates per child. The average pre-operative basal rate was +34.6, the extremes being +86 and +13 (this patient having had iodine for 7 weeks before the metabolic

rate was obtained). All patients responded nicely to iodine. In 4 cases, despite obvious clinical improvement, the basal rate increased. In Helmholtz's series, the metabolic rate varied from +11 to +55. In only 1 of his 14 cases in which rates were obtained on admission was there no reduction after iodine.

Postoperative metabolic studies were obtainable in 10 of the 6 cases. Ninety-two metabolic rate determinations were made on the 22 children, an average of 4.2 rates per patient. The readings were all below +15, which we have arbitrarily chosen as the upper limit of normal. The average postoperative reading was -6.2, the rates ranging from +14 to -30.2. There were 5 cases of mild temporary hypothyroidism readily controlled by thyroid administration, the longest lasting for 6 months after operation. In 2 instances slight parathyroid injury occurred, the only manifestation being a positive Chvostek, which lasted for only a few days without subjective symptoms. There were no nerve injuries and no persistent cardiac damage.

Of the 21 patients exhibiting exophthalmos before operation, 9 returned to normal after operation and 10 showed no improvement. In the 2 other cases, a unilateral exophthalmos persisted.

Accurate pathological data were available in 22 instances, all of which showed varying degrees of hyperplasia and hypertrophy.

It is the practice on this service to do one stage thyroidectomies for thyrotoxicosis, leaving approximately 3 to 5 grams of thyroid tissue. In children, however, a less radical procedure is carried out, more than the usual amount of tissue being left behind. Lahey, in a recent article, stated that because of the uncertainty of possible postoperative reactions in children, practically all cases are done in two stages, the first stage being a right hemi-thyroidectomy followed in 6 weeks by removal of the opposite lobe. Dinsmore stated 4 years ago. In nearly every instance it is necessary to ligate the superior thyroid artery first on one side then on the other 3 months before thyroidectomy. We feel that with proper preoperative and postoperative care and careful technique, a one stage procedure carries with it substantially less risk in younger patients. In this series, no patient was subjected to multiple stage operations. There were no deaths. In the group reported by Helmholtz, 2 deaths occurred among the 24 patients subjected to operation. Dinsmore gives no mortality statistics.

In view of our results, criticism should be directed toward the repeated statements in the

literature regarding the greater hazards of one stage operations for thyrotoxicosis both in adults and children. In a recent communication we reported a series of 860 thyroidectomies in patients under 50 years of age with but 3 deaths. Since then 165 additional patients of all ages have been subjected to one stage thyroidectomy without a death making a total of 1,025 consecutive thyroidectomies for thyrotoxicosis with but 3 deaths (.29 per cent).

Several patients in our series merit special comment. There were two so called recurrences. The first (I D) was seen with a basal metabolic rate of +86 which dropped to +12 on iodine in 11 days. At operation a relatively large amount of thyroid tissue was left because of her youth. She remained apparently well for 2 months after operation having gained 25 pounds then reappeared complaining of nervousness tachycardia and enlargement of the thyroid. The basal metabolic rate was +45. She was reoperated upon 7 months after the first operation at which time large masses of thyroid tissue were found on both sides. She recovered promptly and has been perfectly well ever since a period of 4 years. We are unable to get more accurate follow up data as this patient lives in another state. The second so called recurrence (B H) had a pre operative basal rate of +58 which fell to +48 on iodine therapy. She remained apparently well for 4 years after operation with basal readings of +1 and +8 in the interval. The following symptoms then appeared weakness palpitation tremor weight loss dyspnea excessive perspiration and increase in size of the thyroid. The basal metabolic rate was now +5. She was reoperated upon and has been well for 5 years with consistently normal metabolic readings the last being -17 on August 7, 1930. It is interesting to note that in this patient marked exophthalmos existed which subsided considerably after the first operation reappeared with the advent of the recurring symptoms and subsided again after the second operation. We feel that these cases are not true recurrences but represent persistent hyperthyroidism unrelieved because of inadequate surgery.

Patient A V was operated upon for high grade thyrotoxicosis with pre operative basal rates ranging from +47 to +20. Following operation she remained mildly hyperthyroid for 6 months the metabolic readings varying from +27 to +15. On small doses of iodine given intermittently for 1 year the basal metabolic rate dropped to normal (varying from +1 to -16) the patient gained 31 pounds in 1 year and when last seen 5 years after operation was perfectly well with a basal rate of -16. She was not hypothyroid.

Patient F K also operated upon for high grade hyperthyroidism had a pre operative basal metabolic rate of +60 which fell to +27 on iodine therapy. She remained mildly hyperthyroid for months after operation two basal rates being +25 and +30. She was put on small doses of iodine and in 6 weeks the metabolic rate dropped to +3. Her rate has remained normal for over 4 years varying from -19 to -24.

Patient R C operated upon for moderately severe thyrotoxicosis had a faintly positive Chvostek sign for 2 days after operation. She remained perfectly well for 4 years when following a laparotomy she developed manifestations of severe parathyroid tetany. This was readily controlled with proper therapy. When seen nearly a year later she was free from all symptoms and signs of tetany except that a positive Chvostek could still be elicited.

SUMMARY

1. A report is given of 26 cases in which thyroidectomy was done for thyrotoxicosis the patients being children between the ages of 8 and 16 years. These cases are a part of a series of 1,200 consecutive toxic goiter patients who were subjected to operation.

2. There were 22 girls and 4 boys.

3. The outstanding symptoms and signs were tachycardia nervousness goiter exophthalmos tremor weight loss palpitation left heart enlargement irritability weakness and restlessness. The symptoms correspond closely with those manifested in adults.

4. The average pre operative systolic and diastolic blood pressure readings were 13 millimeters and 65 millimeters respectively. The postoperative readings were 108 millimeters and 72 millimeters. The average pulse pressure dropped from 67 millimeters to 36 millimeters after operation.

5. The average pre operative basal metabolic rate was +34.6. The average postoperative reading was -6.2.

6. All of the glands examined microscopically showed varying degrees of hyperplasia and hypertrophy.

7. One stage thyroidectomy was done in every instance.

8. There were no deaths in this series.

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LUMBOSACRAL SPINA BIFIDA OCCULTA

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SPINA bifida occulta has in recent years been the subject of many interesting discussions dealing particularly with the clinical and pathological features. There is as yet no unanimity in regard to the significance of this defect the view being held by some that it never has any pathological importance whereas it has been shown by others that it is definitely related to certain clinical symptoms. It is very evident that some spinal clefts are entirely innocent yet we must consider them as potential factors of disease not merely as mild defects of the vertebrae but as possible signs of more extensive abnormalities associated with them. The most conspicuous pathological changes which occur in connection with spina bifida occulta are soft tissue masses of fat fibrous tissue and muscle combined in varying proportions and extending from the subcutaneous tissues through the cleft and into the spinal canal where they may either intradurally or extradurally interfere with the function of constituent portions of the cauda equina or the spinal cord.

A realization of the lack of agreement in regard to the clinical importance of spina bifida occulta has prompted this analysis the object being a review of the wide range of conditions associated with this feature and an attempt to determine the mode of development of the different clinical syndromes.

ETIOLOGY

Incidence. The frequency with which spinal clefts have been found by X-ray examination when they were not suspected has led to extensive investigations to determine their presence in normal individual. The figures obtained from such studies show wide variations. It was estimated by Finch that 35 per cent of all people have spina bifida occulta. Wheeler determined from roentgenological studies that defects are found in the lamina of the fifth lumbar vertebra in 3 per cent of adults. Roederer and Lagrot in one thousand examinations found lumbosacral spina bifida occulta in one third of the cases and in one fifth of these thousand cases it was the first sacral vertebra which was involved. The anatomical studies of Willis (61) revealed the presence of clefts of the fifth lumbar vertebra in 12 per cent of 1471 specimens. Bohart and Cushway and Maier in a routine roentgenographic examination of 931 railway employees found 161 cases of lumbosacral spina bifida occulta.

Huntz states that in children spina bifida occulta is a normal finding as it occurs in 91 per cent of children from 1 to 2 years of age. At 11 to 15 years of age it is found in only 3.6 per cent. Cramer noted that 40 per cent of infants have a fovea coccygea but states that this is not pathological unless it extends beyond the twelfth year. The variability in ossification of the lumbosacral region is probably responsible for the greater frequency of spinal clefts in children and this has raised the question whether such clefts should be considered pathological before the eighth year (Steindler).

Biological aspects. From the standpoint of the ultimate cause of these deformities it is probably necessary to consider them as results of primary germ defects or more accurately disturbances in the genes or hereditary factors which are contained in the chromosomes of the germ cell and are thought to be the determinants of the characteristics which they govern in their development. Thus the view held by biologists and is emphasized by Aschner and Engelmann who concluded that these localization genes or gene complexes may be altered and transmitted to succeeding generations so as to produce abnormalities in various structures or organs. A tendency to familial occurrence of spina bifida occulta is mentioned by Alpers and Waggoner who found this defect in 1 of 6 members of one family. Ernst mentions the occurrence of lumbar hypertrichosis in three generations—grandfather, father and son.

Another factor of importance in the production of these anomalies is the fact that this region is one which is undergoing marked phylogenetic changes. This point is emphasized by Willis (61) and by Steindler who consider the spine from the standpoint of the number of presacral segments. The modal number of presacral segments being 4 an increase in number (5) is evidence of a reversion to atavism whereas a decrease in number (3) indicates a forward trend of development and has a futuristic significance. From the investigations of Willis (61) it is seen that 15 per cent of 1471 skeletons had 23 presacral segments and 42 per cent had 5 presacral segments. Such variations are interpreted as phylogenetic changes and represent the attempt of the human organism to evolve from a lower type with lengthening of the spinal column to a more highly developed type with a shorter column.

These facts have a definite biological significance and serve to explain in some measure why anomalies are so frequent at this site. Aschner and Engelmann (3) have frequently noted that structures or organs which are undergoing phylogenetic changes are more prone to exhibit variations. It was stated by them that structures which are phylogenetically more recent to develop show malformations more frequently and likewise of greater extent. Applying this statement which assumes the importance of a biological axiom to the various forms of maldevelopment in the lumbosacral spine would partly at least account for the frequency and variety of abnormalities in this region.

As a further predisposing factor in the causation of these anomalies we have to consider the variability in ossification. Ossification is the continuation of developmental processes which have their beginning very early in fetal life and depends largely on the stability of the anlagen which are destined to become bony tissue. This would of course have to take into consideration the chondrogenous stage and the blastemal stage. It is reasonable to suppose from the irregularity of ossification and from defects seen in the bony structures that the process of normal bony development must depend on the integrity of the pre osseous tissues—that any defect in ossification may be rightly attributed to an inherently defective condition of the anlage and in most of the defects we must perhaps look for the origin in the tissues in the blastemal stage. This is evident from the fact that in some anomalies there is not only a complete lack of bony structure but also an absence of any form of pre osseous tissue indicating a defective anlage or a developmental arrest in early fetal life. Such a defect was seen in a case of congenital club foot where the posterior wall of the sacrum was absent and the meninges were adherent to the subcutaneous tissues through a wide sacral cleft (21). In the same specimen there was a complete defect of the laminae of the lower lumbar vertebrae on the right side the bony defect being covered only by the spinal muscles. In a specimen of amelia seen by the writer there was a complete absence of spinous processes and laminae and the pedicles were rudimentary ().

The process of ossification is important for the reason that we may have all grades of defects from a complete aplasia of the bone to developmental arrests at any state of the process or perhaps merely a delay in attaining a normal appearance. The frequency of bifid neural arches in the fifth lumbar vertebra may be in part due

to the fact that this vertebra in some instances has a special mode of development. This consists in the formation of two centers in the arch on each side one for the root transverse process and superior articular process the other for the lamina inferior articular process and spine (Bardeen Thompson). Such a manner of formation would add to the complexity of development and would be in some measure responsible for defects of that portion.

PATHOGENESIS

Pathological features. Our knowledge of the abnormalities associated with spinal clefts is derived partly from autopsy study and partly from findings at operation. In the classical description by von Recklinghausen of a case of congenital club foot with hypertrichosis and spina bifida occulta we have the basis for subsequent investigation of the pathological changes in this condition. The spinal defect consisted of a sacral cleft which was occupied by a mass of fibrous tissue extending from the subcutaneous area into the spinal canal. Here it proceeded through the dura and was intimately related to the cauda equina and the spinal cord which had been lengthened to the extent of five segments. This abnormal structure consisted of fibrous tissue fat and muscle. Ribbert described a case very similar to this with the exception that there was more muscle and less fat. In this the lumbosacral cleft was covered by a dense fibrous membrane with a slit like opening through which a heavy fibrous band took its course. In Bohnstedt's case a myofibrolipoma extended from the subcutaneous region through a sacral cleft into the intradural space and surrounded the nerves of the cauda equina.

Further information on the abnormal conditions was obtained from operative procedures designed to obtain relief from various disease processes. Among the first reports were those of Jones Maass Katzenstein Voelker and Reiner. While the clinical conditions for which operations were undertaken varied greatly the pathological features were very constant. The latter consisted of masses of fibrous tissue and fat fibrolipomata which were in close relationship to the cleft and frequently were attached extraspinally to the subcutaneous tissues. Intraspinally these masses of tissue at times proceeded through the dura and involved the nerves or cord but for the most part, they were extradural and produced their effects by pressure or traction on meninges or nerves.

Link, in a series of 46 autopsies on infants 7 to 8 weeks old found that normally there is no

fat deposit in the epidural space. In 11 cases he noted laminal defects which were covered by the membrana reunens posterior. In 7 of the latter there were masses of fat tissue and fibrous band from the contents of the sacral canal to the periosteum. These fibrous bands connected the dura and nerves to the wall of the canal.

In a case of congenital club foot the writer found an extensive fibrolipomatous mass occupying a sacral cleft and firmly attached to the dura underneath to produce an elongation of the spinal cord. This mass was entirely extradural. Microscopically it consisted mostly of fat tissue and fibrous tissue. In several areas examined no muscle fibers (hematoxylin eosin stain) or nerve fibers (Spälmeyer stain) were found.

Genesis of myofibrolipomata. In seeking an explanation for the occurrence of these abnormal structures we probably have to refer them to the blastemal stage of bony development. It is quite generally agreed that they appear at a very early period of fetal life, probably not later than the beginning of the third week. The manner of development is expressed by von Recklinghausen as follows: "This arrangement is positive evidence that the disturbance occurred at a time when the muscle germs differentiated from the anlage of the laminal arches but that the laminal arches left open a path for the muscle masses to gain entrance into the interior of the cartilaginous canal." Nothing opposes the assumption that the fat tissues entered the canal at the same time as the muscle.

The conception of von Recklinghausen requires perhaps a slight modification as at this stage of development the transposed tissues are primitive embryonic tissues. Although fibrous tissue appears early in the embryo, adipose tissue is not found until the fourth month (Bardeen). The histological appearance of the fat fibrous tissue and muscle in myofibrolipomata was normal. This indicates a well marked independence of these primitive tissues after being placed in a different environment and their ability to persist and to differentiate after such transposition undoubtedly has an important bearing on the development of the symptoms seen clinically. As these tissues can retain their power of growth and can develop parallel with the development of the other tissues of the body, it would explain why pressure symptoms occur and also why they make their appearance at variable ages of the individual. This may explain also the apparent latency of symptoms in some cases.

As we have in the embryonic stage a variable inhibition of bony development of the vertebral

arches which may consist of a complete suppression or merely a retardation of growth, a characteristic not seen in the other tissues, we may conclude that the primary alteration in the genesis of the abnormality is that of the primitive bony tissue. The muscles derived directly from the myotomes—the deep muscles of the back and the intrinsic thoraco abdominal muscles—are to be considered both phylogenetically and ontogenetically the oldest of the skeletal muscles (Lewis). From this it may be assumed that the muscles of that region would be constant in their development and show no great variation due to peculiarities of their own.

Among the most important structures therefore in the causation of abnormalities seen with spina bifida occulta, we have to consider principally the embryonic tissues of that region which are destined to become fibrous tissue, fat, muscle and bone, and of these we see by far the greatest variability of growth in the bony tissue. As the other tissues possess a greater stability of growth it is reasonable to infer that the primary change which occurs in a deviation from the normal course of development is that which is seen in the embryonic bony tissue.

The anatomical arrangement of soft tissue masses as myofibrolipomata indicates a close relationship of these structures to the meninges. Thus we see that in some instances they proceed intradurally and come in contact with the spinal cord which is usually elongated as a result of the firm attachment to the tissues near the cleft. At other times the adhesions may involve the meninges alone over a wide area. In addition we may have masses of transposed fat and fibrous tissues overlying the dural sac where they produce a constriction or pressure upon the cauda equina. And finally, the peripheral nerves alone may be affected. These features show that transposition of such tissues occurs at a time when the meninges are developed in some instances undoubtedly before the meninges are completed dorsally, as shown by the intradural displacement in others after that stage has been completed as demonstrated merely by adhesions.

Defects of the medullary plate. In discussions of the abnormalities in spina bifida occulta, reference is frequently made to defects of the medullary plate. The work of Ernst on malformations of the central nervous system is used to explain many of the complicated changes which affect the lower portion of the spinal cord and which are considered to be the outstanding defect responsible for neurological symptoms. While it is evident that the investigations of Ernst form an

important part of our knowledge of maldevelopment of the nervous system yet it is obvious that his views cannot be applied unreservedly to the changes ordinarily seen in spina bifida occulta. Ernst states that malformations of the central nervous system are practically always the results of incomplete closure of the medullary groove. He refuses to accept the possibility that mesodermal structures (bones muscle) play any part in the development of spina bifida and justifies his attitude by stating that the closure of the medullary groove precedes the formation of the vertebral arches so that the blastema for the spinal canal must adjust itself to the medullary canal and not the reverse. This opinion had been previously expressed by v. Monakov.

The extensive defects which Ernst described are in marked contrast to the appearance of the spinal cord in spina bifida occulta and though in their milder forms they may produce similar symptoms it is necessary to differentiate the two types of lesion with respect to their developmental features. An incomplete closure of the medullary groove represents a primary malformation of the cord whereas the appearance of the cord in spina bifida occulta is usually normal or presents a secondary degenerative process. We have therefore two separate and distinct pathological entities.

In his conception of amelia Ernst maintains the same fundamental basis. However he concedes the normal development of the peripheral nerves which would necessitate the intactness of the central nervous system at least to a certain stage of development. In amelia the relations are such that the process of development may be interpreted as one which affects primarily the bony architecture and secondarily the spinal cord. The conclusion was drawn from the study of a case of amelia in which the peripheral nervous system was fully developed (22). These findings are also in accordance with those of Staemmler who reported a normal appearance of motor and sensory nerves and spinal ganglia.

In 1909 Fuchs as a result of clinical observations expressed the belief that many syndromes can be explained by assuming a hypoplasia or dysplasia of certain portions of the spinal cord. Such a condition was held responsible for the occurrence of enuresis nocturna, syndactyly of the toes, sensory disturbances, defects in the lower cord and the sacrum (spinal clefts), disturbances of abdominal and tendon reflexes and weakness of the peronei with consequent deformities of the feet. This marked the beginning of the doctrine of myelodysplasia which sub-

sequently has found many proponents and has been used indiscriminately to account for conditions which presented no definite pathological changes.

Such a theory is open to serious objections not the least of which is the fact that it has never been proved morphologically. The presence of such a lesion would obviously preclude the possibility of benefit by surgical intervention yet it has been repeatedly shown that conditions described by Fuchs are amenable to treatment. The symptoms of a hypoplasia of the cord should make their appearance early in life but it is frequently found that they present themselves at different ages of the patient. And finally the symptoms of so called myelodysplasia are usually associated with definite pathological alterations which are sufficient to account for the neurological disturbances.

Spina bifida occulta is in some instances combined with external manifestations of the skin over the cleft as hypertrichosis, pigmentation, scars or retraction. Such manifestations when present are pathognomonic of spina bifida occulta and while they occur in relatively few cases they probably have a definite significance. The changes seen with spinal clefts are interpreted by many authors as a disturbance of the transition from the medullary groove to the medullary canal. This would indicate a defective formation of structures which are derived from the primitive ectoderm and in case of primary malformation of the cord it is reasonable to suppose that defects of the ectodermal tissue may be manifest in the skin over that area as well as in the cord underneath. It seems that such external manifestations of the skin constitute the closest approach to an anomaly of the cord as the two have a common origin. An example of this was seen in Case in which a small sinus tract led down from the skin toward the spine. In cases of hypertrichosis as described by v. Recklinghausen, Ribbert and Bohnstedt the most formidable lesions of the cord and cauda equina were found when such external manifestations were present yet even in these there was a decided preponderance of mesodermal element participating in the anatomical construction.

CLINICAL ASPECTS

The large variety of clinical conditions which have been brought into relation with spina bifida occulta include peripheral phenomena and visceral disturbances. Among the former the most important are deformities of the feet principally club foot and hollow foot. Congenital club foot

has been interpreted by a number of different observers as the result of a muscular imbalance of the foot but it has been difficult to define exactly the manner in which this deformity develops on such a basis. The difficulties have been partly overcome by establishing the fact that the musculature of the leg is abnormal.

In examining a specimen of congenital club foot the writer was able to demonstrate definite pathological alterations in the muscles (21). These consisted of various degrees of atrophy which was most severe in the peronei. In practically all the muscles examined some form of atrophy was noted but in the evertors and dorsiflexors of the foot it reached its most marked form manifested as a fibrosis of the muscle tissue. In the same specimen the peripheral nerves of both legs presented a normal appearance but the lower spine was the seat of definite changes. The spinal cord was lengthened as a result of firm adhesions between a subcutaneous fibro-lipoma and the meninges. The cord was necrotic at its lower end but on cross section study at the level of the cleft it showed no abnormality. In addition the arrangement of the nerves of the cauda equina was altered. From this study it was apparent that congenital club foot can be brought into a definite relationship with spina bifida occulta the probable mechanism of development being one which affects the component portions of the peroneal nerve more than the other nerves arising at that level of the spinal cord.

The occurrence of atrophic muscular changes in congenital club foot has been substantiated recently by Mau. However from his study of a fetus of 8 months a different interpretation was placed on the relative importance of the two main groups of muscles controlling the position of the foot. He found that the most marked atrophic changes were present in the tibialis posterior the flexor hallucis and flexor digitorum longus. The same changes although somewhat less severe were found in the peronei and the tibialis anterior. In none of the muscles was the process so pronounced that it could be considered a degenerative atrophy. In addition an extensive defect was present in the lumbar vertebra. Mau considers the deformity as one which is brought about mostly by the invertors of the foot particularly the tibialis posterior.

The investigations of Mau are also directed toward the question of physiological supination of the foot. This is a much disputed point as seen from the studies of Bohm. The so-called physiological supination which is predicated by some authors and denied by others occurs during an

early part of fetal life before there is any possibility of muscle action. A congenital club foot which rests on a neurogenic basis must depend on muscular activity. In a foot in which the controlling muscles are defective that feature alone would be sufficient to account for the deformity and would certainly outweigh in importance the effect produced by a normal supination through which the foot passes. On the other hand in a foot which has a normal muscular balance it may rightly be expected that by such balance any deformity which may be due to a physiological supination can be overcome. In this respect a physiological supination of the foot occupies approximately the same position as the flexed hip, knee or elbow during intra uterine life and therefore the question of presence or absence of a normal supination of the foot is one which is purely of academic interest and has no great bearing on the production of a congenital club foot. It is possible that this supinated position may be maintained until after birth. The writer has had occasion to see an infant with a congenital club foot which according to the obstetrician was definitely contracted in a position of equinovarus. On the sixth day after birth the foot could be completely corrected by active control of the muscles although no treatment whatever had been administered.

Brockman in a recent publication discusses congenital club foot from the standpoint of the interrelation of the tarsal structures. Muscle action is not considered important as an influence in the production of the deformity but is stressed as a means of arriving at a cure by attaining proper balance.

Whatever may be the prevailing opinions in regard to the cause of club foot it is evident that our efforts must be directed toward a more intensive study of the muscular apparatus of the foot.

Hollow foot or claw foot in its relation to spina bifida occulta has been studied particularly by Hackenbroch who reported the results of operations in 70 cases. In 60 per cent of these positive changes were found in the spine and in 30 per cent definite benefit was obtained. Hackenbroch also calls attention to the possibility of positive operative findings in cases in which X-ray examinations revealed no abnormality (spina bifida occulta Denue). In 2 cases of hollow foot reported by Brechot spinal clefts were present and by performing a laminectomy one case was cured and the other was greatly benefited.

The anatomical basis for claw foot is probably the same as that for club foot with the exception

that fewer muscles are involved. This would depend on the extent to which the nerves arising from the lumbosacral region meet interference by fibrolipomatous structures and likewise on the level at which such changes occur. In a hollow foot the deformity is chiefly due to a paralysis of the dorsiflexors while the evertors remain intact.

Two cases here reported were seen at the Los Angeles Orthopaedic Hospital School and show the relationship of spina bifida occulta to foot deformities.¹

CASE 1. E. N. No. 2316 male 8 years of age was first seen in the clinic in September 1924. He was referred on account of deformity of feet. Examination showed a moderate degree of claw foot bilateral (Fig. 1). There was no complaint of back trouble. The X-ray showed a complete sacralization of the fifth lumbar vertebra and a bifid lamina arch of the first sacral segment (Fig. 2). Treatment consisted of tarsal stabilization. This patient also had a nocturnal enuresis which according to the follow up record continued until he was 12 years old.

CASE 2. M. C. No. 2642 female 12 years old was seen in the clinic in March 1925. The complaint was deformity of both feet. The father stated that at the age of 4 years the patient had spinal meningitis and spent 6 months in a hospital. After that it was noticed that the feet became deformed. The deformity has been progressive. Examination showed a dorsal round back and moderate degree of claw foot bilateral but worse on the left (Fig. 3).

In the lumbosacral region is a funnel shaped depression in the center of which is a small sinus leading toward the spine (Fig. 3). This has been present since birth. A cleft cannot be definitely felt. Treatment consisted of stripping of the os calcis with arthrodesis of the astragaloscaphoid and calcaneocuboid joints on the right and transtarsal osteotomy on the left. The X-ray examination (Fig. 4) shows a wide defect of the lamina arch of the fifth lumbar vertebra and cleft of the upper two laminae of the sacrum.

Paralyses of different degrees of severity are not uncommonly found with spina bifida occulta. Hoelen reported one case in which the first symptom was a bilateral paralysis of the peronei. The X-ray examination showed a lamina defect of the first sacral vertebra and the spinal fluid had a very high albumin content. At operation a mass of fat and connective tissue was found to protrude into the spinal canal through the gap. Following removal of this mass all the nervous symptoms subsided and within a year the feet had returned to normal shape. In the case of Maass various paralytic disturbances were associated with a spina bifida occulta of the entire lumbar region. At operation a fibrolipoma was found to constrict the dural sac. Spiller (51) reported several instances of spina bifida occulta with atrophy and motor disturbances of the lower extremities. Bufalini has observed 4 cases of late paralysis of the lower limbs and associated with spinal

clefts. In of these the paralysis was spastic in type.

In the knee the principal deformity seen with spina bifida occulta is a flexion contracture usually congenital. According to Delcroix spinal clefts may be a factor in producing the deformity. He states further that in 25 of 29 cases on record the anomaly was bilateral and it was always progressive or inclined to recur. The importance of spina bifida occulta in flexion contracture of the knee is illustrated by Ascher who had occasion to perform a laminectomy in one case which relapsed after correction of the knee. He found a large mass of tissue occupying the epidural space underneath a cleft of the fifth lumbar and first sacral vertebrae. This was resected and on microscopic examination was found to consist mostly of fat and fibrous tissue with small amounts of muscle bone and cartilage. There was a marked improvement in the condition following operation. Matzdorf in a study of 3 cases with spinal clefts described a disturbance of gait which consists of walking with the knees partly flexed and is probably due to contraction of the flexor muscles of the knee. Stendler observed 4 cases of congenital dislocation of the knees accompanied by spina bifida occulta.

Congenital dislocation of the hip combined with spina bifida occulta was first mentioned by Lucke. Extensive investigation of the association of these two conditions is lacking and their relationship is not clear. Pieri has reported the occurrence of dislocation of the hip with spina bifida occulta in 18 cases. Beck states that in 30 cases of dislocated hip spinal clefts were found in 6 and Spisic noted 7 instances of spina bifida occulta in 10 cases of dislocated hip. Further observations of this combination were reported by Brunner (12) Sever and Colly.

Sensory disturbances as hypæsthesia, anesthesia and paræsthesia occur very frequently with spina bifida occulta and are usually accompanied by other symptoms. Thermal hypæsthesia has been emphasized by Fuchs. The areas most affected are the outer border of the foot and the toes. Finck states that 84 per cent of cases of spina bifida occulta show an anesthesia of the plantar surface of the foot.

The development of trophic ulcers as a result of spinal defects has attracted attention largely because such ulcers are extremely resistant to treatment. They occur mostly on the plantar surface of the foot and frequently involve not only the skin and subcutaneous tissues but also the bones especially the metatarsals. In several instances severe infections developed which

necesitated amputation. In one case examined by Sutton the posterior tibial nerve was the seat of extensive changes. The fasciculi were separated by collections of fat and in no part was healthy nerve tissue detected. The arteries showed a marked increase in the size of the muscular layer. In another case examined by Brunner (13) the nerves presented the appearance of a hyperplastic neuritis. It is probably significant that the most extensive changes in the peripheral nerves have been associated with trophic ulcers and likewise the simultaneous occurrence of changes in the blood vessels is perhaps more than a coincidence. That the pathological changes in the spine have a definite role in the causation of these ulcers is shown by the improvement which followed removal of the injurious influences. This is evident from the reports of Jones, Elsberg, Katenstein, Kochs and Brickner.

Visceral disturbances, especially enuresis nocturna, have been observed very frequently in connection with spina bifida occulta. It was stated by Peritz that spinal defects are found in 68 per cent of adults and in 55 per cent of children. Fuchs examined 10 cases of enuresis and found clefts of the sacrum in 6. Mertz and Smith recently reported 6 cases of dilatation of the ureter accompanied by urinary disturbances, mostly enuresis, and conclude that such changes are neurotrophic in origin and related to spina bifida occulta. In one of their cases operation revealed that the sacrum was open throughout posteriorly and under the membrane covering the hiatus was a pad of fat which was most prominent opposite the first and second sacral vertebrae. Delbet and Leri performed operations on 4 patients with enuresis. In 2 of these spinal clefts were demonstrable. The operation revealed in every case a fibrous band bridging the gap in the spine and compressing the dural sac and nerves of the cauda equina. By resection of these fibrous structures 10 patients, including all cases of purely nocturnal enuresis, were cured and 10 were slightly improved. F. J. Cramer reported 4 cases of enuresis with spina bifida occulta. By operation a cure was obtained in 2. Brechot performed a laminectomy of the lumbosacral region in 6 cases and obtained partial cures in all of them. Among 19 cases of enuresis observed by Jacobovici, Urechia and Teposu it was demonstrated that 16 had spinal clefts and 3 had other osseous defects. Of this group 15 were subjected to operation which consisted of a laminectomy. The operative results showed that 9 were cured, 3 were relieved, 1 was partly relieved, 1 showed no change and 1 died. Colby related an instance of urinary retention

and constipation with a cleft of the fifth lumbar vertebra and the sacrum. The operation which consisted of resecting a lipomatous mass from the dural sac and sacral nerves resulted in a cure in 4 weeks. Francois reported 2 cases of stubborn constipation and urinary retention associated with spina bifida occulta. The changes in the spine consisted of a compression of the dural sac by heavy yellowish ligaments. By removal of these structures complete cures were obtained.

The relationship of spina bifida occulta to low back pain has been a matter of great interest and in this connection there is evidently a decided divergence of opinion among different observers. Willis (60) states that whereas spinal clefts are normally found in only 12 per cent of specimens he has been able to demonstrate such defects in 10 per cent of 100 consecutive cases of low back pain. On the other hand Bohart and Cushway and Maier do not believe that spina bifida occulta plays any part in the causation of low back pain. They arrive at this conclusion from the fact that railway employees performing heavy labor and subjected to accidents are no more liable to suffer injury because a cleft is present. Margulis mentions the occurrence of a lumbosacral syndrome consisting of pain and paralysis as a component of the clinical picture of spina bifida occulta. Westcott and Gudzent believe that certain cases of sciatica are related to clefts of the lumbosacral region.

The following case is reported to illustrate a peculiar type of disability of the back, with a coexisting spina bifida occulta.

J. W. G. male, 63 years, was first seen May 9, 1917. He complained of pain in the lower part of the back. He had a history of injury to the back in 1914, when he was working for the railroad. He stated that the pain was so bad that he could not get on his feet. He had been in the hospital for several months, but the pain continued. He was then referred to me. On examination I found a cleft in the lower part of the back, between the fifth lumbar vertebra and the sacrum. The cleft was about 1 cm. wide and 2 cm. deep. The skin over the cleft was normal. The pain was relieved by the operation. The patient was discharged on June 1, 1917, and has remained well since that time.



Fig. 1. Photograph showing deformity of feet in Case 1.

The X-ray examination revealed a narrow cleft of the lamina of the first sacral vertebra. This extended downward toward the second sacral vertebra and in its lower portion was considerably wider than at the upper end. The area of the defect was somewhat indistinct and apparently was undergoing calcification. In addition there was a bilateral transverse process of the fifth lumbar vertebra and a hypertrophic arthritis of the lumbosacral joint.

Following the examination the patient was not seen for about a year. During that time he developed urinary disturbances consisting principally of attacks of nephrolithiasis.

The pain in the lower back was at this time somewhat less severe but in addition he had very frequently experienced a snapping sensation in that area. This would occur when he performed certain movements as getting up from a stooped position at times also when he was sitting



Fig. 2. Roentgenogram showing spinal defect in lamina of first sacral vertebra. Case 1.

time down and performed certain movements as twisting his body or even raising his arm. The snapping was always accompanied by pain which radiated for a short distance to either side of the midline. Also it was located in the same area where his previous pain had been. The sensation according to the patient was very much like that perceived when hitting the crural bone of the arm. Also he developed a weakness of the back which consisted of inability to rise from a stooped position until he had flexed his thighs and knees. He stated further that at this time he was unable to hold his urine especially at night. This he attributed to his urinary condition.

Examination at this time showed a greater range of mobility of the spine although it was still limited. Tenderness was not present except at the upper end of the sacrum. At the site of the cleft as seen in the roentgenogram it was possible to palpate a small mass of firm tissue which was closely adherent to the sacrum. The consistency was that of heavy fibrous tissue or cartilage. Firm pressure on this small mass produced a sensation of pain very similar to that experienced by the snapping of his back. In addition it produced the sensation of a desire to urinate. Beyond that no other findings could be detected by examination.

The principal points of interest in this case are the disability due to low back pain, the urinary disturbances and the X-ray findings. In the presence of spinal clefts it is necessary to bear in mind the frequency with which such defects are combined with other pathological features as abnormal masses of fibrous tissue, fat, etc. In the case under discussion the most striking characteristic is the possibility to reproduce the symptoms which constitute the complaint of the patient.



Fig 3 Photograph showing the first dorsal sacral cleft with the following characteristics: small, shallow, diamond-shaped, with a small pit in the center.

The sensory disturbances noted here are such as would be caused by irritation of the posterior primary division of the upper sacral nerves and it is very likely that such irritation is produced by abnormal fibrous structures extending through the cleft. The urinary condition which developed into an enuresis may be explained on the basis of irritation by such structures of the sacral autonomic nerves. Such a process may well be considered as an important factor in all cases of enuresis in which the pathological features are

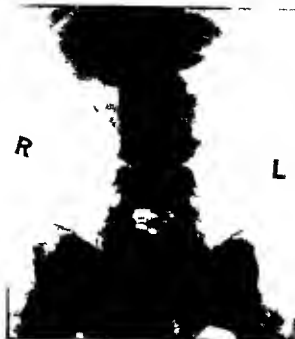


Fig 4 Right and left buttocks showing the first dorsal sacral cleft.

demonstrable in the spine. The probability of interference with the function of the autonomic nerves was mentioned by F J Cramer who stated further that the stimulating phenomena may gradually develop into paralytic phenomena.

There remains further the question whether some of the physiological disturbances of the function of somatic nerves can be explained on the basis of irritation with consequent stimulation on the one hand and partial or complete physiological interruption on the other. In the case of sensory nerves an irritation or stimulation would be manifested as pain or paræsthesias whereas a complete interruption would appear in the form of anaesthesia or hypæsthesia. That a similar phenomenon occurs with motor nerves is quite possible and is most strongly suggested by the flexion contracture of the knee. In such a condition the two possibilities to consider are a paralysis of the quadriceps extensor and an overactivity or spasticity of the flexors of the knee. The flexors of the knee receive their nerve supply from the upper sacral nerves and therefore from a level which is most often the seat of congenital anomalies with their concomitant pathological changes. The extensors of the knee on the other hand are innervated by nerves arising at the level of second third and fourth lumbar segments which are rarely affected by such abnormalities.

Therefore the topographical arrangement is such that the nerves to the flexors are more liable to meet interference with function and under such conditions a flexion contracture of the knee would be produced by a functional disturbance of the flexors rather than by one of the extensors.

TREATMENT

The form of therapy to be used in cases of spina bifida occulta must of course depend largely on the gravity of the symptoms. The course which is frequently pursued is operative treatment of the abnormality in the spine. This consists of laminectomy and removal of fibrous bands and lipomata which are in relation to the meninges or the nerves of the cauda equina. This procedure however is still in the experimental stage and the indications for it are not yet clear. K. Cramer and Hackenbroch advocate this form of treatment in cases in which there is a progression of symptoms. Cramer considers the presence of tenderness over the cleft as a valuable sign in the diagnosis of spina bifida occulta and also in deciding on operative interference. Brickner advised operation in infants and children with signs but no symptoms and in adults with sufficiently serious and progressive symptoms. Sever believes that operation is not indicated in a large number of cases especially when not associated with pain anaesthesia or complete paralysis. F. J. Cramer stated that patients with urinary disturbances in combination with spinal clefts offer a poor prognosis as to life and without operation death may be expected in the third decade. While the operative results in some conditions as enuresis indicate a decided benefit to the patient in other disturbances they are not so satisfactory. It would be difficult to formulate definite indications and it is obvious that surgical procedures must be considered from the standpoint of the symptoms in each individual case.

SUMMARY

Spina bifida occulta is a congenital defect found most commonly in the lumbosacral region and frequently associated with other abnormalities which are responsible for the appearance of symptoms. The abnormalities consist usually of masses of fibrous tissue fat and muscle tissue which are located in or near the bony defect and by extension interfere with the function of the nervous structures underneath the cleft. Developmentally the most probable process of malformation is one which affects primarily the bony structures the alteration in the soft tissues being brought about by a transposition of tissue in the

sense of von Recklinghausen. Such a mechanism of formation is most nearly in consonance with the pathological changes seen at autopsy and at operation and must be differentiated from the process of primary malformation in the cord itself. Clinical observations indicate that a large number of syndromes can be definitely traced to such anomalies of the spine. The importance of spinal clefts is illustrated by the investigations of Lampar who found among 40 cases of spina bifida occulta only one who did not present neurological symptoms (Ascher). Operative treatment by laminectomy and removal of injurious influences has yielded a relatively high percentage of beneficial results.

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V l l p 535
- 53 ST MUXER M D L tw kl g ta d de p ph
N v t ms b An ephali d Amy
l A h f p th A at 9 4 ccl
- 54 S NDLF A D eases d D f mt f th Sp
a d Th ra St Lo is Th C V M by C 9 9
- 55 SUTTON J BLAND Sp a b fid cc lt d ts l
t t l p rfo o s nd pes ru La t
887 4
- 56 THOMPSON P Th Sk l t M n Anat my
sth d Phl d lph P Bl k t So & C
9 4
- 57 VO LCK R F Sp b fid Ita M he m d
W h schr 9 3 l 8
- 58 WE TOTT H Sp b fid cculta d u
kl W h sch 9 2 6
- 59 WH E T Q t d by M tz d Smth
- 6 W s T A B ck ch f m t bral n m ly
S g Gy & Ob t 9 4 658
- 6 Id m A lys I e t b l a m l Am J
S g 9 9 63

RESULTS IN RELATION TO THE SITE OF AMPUTATION IN THROMBO-ANGIITIS OBLITERANS¹

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IF amputation becomes necessary in cases of thrombo-angiitis obliterans it is often difficult to decide on the proper site for operation. Such a decision is of great importance particularly since in young persons conservation of as much of the extremity as possible is highly desirable. We present here the results of a study of 102 amputations in cases of thrombo-angiitis obliterans which was made to determine if possible any valid criteria by which the operative site might be chosen.

Our study was confined to procedures on the lower extremities not including amputation of the toes or portions of the foot because these procedures can usually be employed only in cases in which there has been sudden thrombosis of the vessels of the toes with either or both of the main vessels of the foot pulsating normally or (4) in selected cases in which the blood supply has been enhanced by previous lumbar sympathectomy (Fig. 1). Our interest in the individual case lies chiefly in whether the extremity can be successfully amputated below the knee or above it.

Sixty-four of the 102 operations were performed at The Mayo Clinic and 38 were performed elsewhere (Table I). This series includes the group previously reported by Allen and Meyerding.

Of the 45 cases in which amputation was performed below the knee at The Mayo Clinic healing occurred by primary intention in 28. Healing was delayed in 8 cases and absent in 9. In the latter higher amputation was necessary. In 5 cases amputation below the knee was performed elsewhere than at the clinic. In 18 primary healing apparently occurred according to the patient's statement. Healing was delayed in 6 cases and in 1 case higher amputation was necessary later. In the 70 cases healing by primary intention occurred in 46 (66 per cent). Healing was delayed in 14 cases (20 per cent). Thus 86 per cent of the amputations below the knee were ultimately successful. In 10 cases (14 per cent) higher amputation was necessary.

In 19 cases amputation was performed above the knee at The Mayo Clinic. In 17 cases the

wound healed readily and in 2 cases healing was delayed. Amputation above the knee was performed elsewhere in 13 cases. In 10 cases primary healing apparently occurred in 1 case healing was delayed and in 2 cases higher amputation was necessary. Of the total of 32 cases healing by primary intention occurred in 27 (84 per cent). Healing was delayed in 3 cases (9 per cent). In 2 cases (6 per cent) higher amputation was necessary.

In the entire series amputation was performed below the knee in 50 per cent and above the knee in 41 per cent. The cases of amputation below the knee included those with primary healing and those with delayed healing. The cases of amputation above the knee included those in which the amputation was performed directly above the knee because it was the site of choice, and cases in which healing below the knee was not satisfactory.

The successful amputations below the knee were compared with those that were not successful and with those in which amputation was directly above the knee (Tables II, III and IV).

A history of previous superficial phlebitis apparently has no bearing on the prognosis of

TABLE I—RESULTS OF AMPUTATION

| | C | | | P |
|-----------------|--------------|----------------|-------|------|
| | At Clinic | Else- where | Total | |
| Below the knee | | | | |
| Primary healing | 28 | 8 | 46 | 66 |
| Delayed healing | 8 | 6 | 14 | |
| Healing absent | 9 | | 9 | |
| Total | 45 | 14 | 59 | 100 |
| Above the knee | | | | |
| Primary healing | 7 | | 7 | 81.4 |
| Delayed healing | 2 | 3 | 5 | 9.4 |
| Healing absent | | | | 6 |
| Total | 9 | 3 | 12 | 100 |

TABLE II—AMPUTATIONS BELOW THE KNEE

| Case | Age | R | U t b gr d | C d l | | | Typh d m dm d |
|------|-----|---|------------------|-------|-------|------------|---------------------|
| | | | | F m l | P p l | Pos tbl | |

S f l (N y Ch se)

| | | | | | | | |
|----|------|------------|---|----|---|-----|---|
| 37 | Ge m | | | | | | 6 |
| 5 | I h | | | | | | |
| | G k | | | | | | 5 |
| | F h | 3 | | | | | |
| 5 | Il | | | | | | |
| 6 | 3 | F h | | 3 | | | |
| | 3 | G m | | | | | |
| 8 | | S h | | | | | |
| | | S h | | p | | | |
| | | J w h | | | | | |
| 35 | | J w h | | pe | | | |
| | | Am | | | | | |
| | | J w h | | | | | |
| | | S h | | | | | |
| | | G m P l h | | p | p | | |
| 6 | | J h | | | | | 7 |
| 8 | | G l | | | | | |
| 3 | | A | | | | | |
| 9 | | C d | 3 | | | | |
| | | Am | | | | | |
| | | Am | | | | o-f | |
| | | Ge m P l h | | | | | 4 |
| | | I h | | | | | |
| | | Am | | | | | |
| | | Se h | | | | | 7 |
| | | h | 3 | | | | 7 |
| | | D h Am | | | | | 5 |
| 5 | | J h | | | | | 5 |

S f l (lewh)

| | | | | | | | |
|---|--|------------|---|----|--|-----|--|
| | | J h | | | | | |
| | | Se m C h | | | | | |
| 5 | | Ge l | | pe | | | |
| | | Am | | pe | | | |
| | | I h | 3 | | | | |
| | | R | | | | | |
| 6 | | I h | | | | | |
| | | Am | | | | | |
| 3 | | Am | | | | | |
| | | Am | | | | | |
| 3 | | A | | | | | |
| | | E l h | | | | | |
| | | Am | | | | | |
| 3 | | Am | | | | | |
| | | Am | | | | | |
| 5 | | Ge m | | pe | | | |
| | | Se h E l h | | | | o-f | |

Pulsa gr d d f m t p m l p l
p es bse p l a
11 mu p l

TABLE III—AMPUTATIONS BELOW THE KNEE

| Case | Age | R | Use t b g d | C d l f | | | Typh l m dm d |
|------|-----|---|-------------------|---------|-------|----------|---------------------|
| | | | | F m l | P p l | P b l | |

D l y d h l g (M y Cl)

| | | | | | | | |
|---|----|-------|---|---|---|-----|---|
| 7 | 7 | | | | 3 | o-f | 4 |
| 8 | 5 | E l h | | | | | 3 |
| 9 | | G l | | | | | |
| 5 | | I h | | | | | |
| | 3 | G m | | | | | 4 |
| 5 | 6 | Am | | | | | |
| | 5 | Am | 3 | | | | |
| 5 | 38 | J h | | 4 | | | 7 |

D l d h l m (l h)

| | | | | | | | |
|----|----|----------|---|--|-----|---|------|
| 55 | 6 | C d | | | | | |
| 6 | 6 | E g l h | | | | | |
| 57 | 37 | Ge m S h | 3 | | | | |
| 58 | 39 | D h F h | | | | | |
| 5 | 35 | E l h Am | | | o-f | 6 | give |
| 6 | | G m I h | | | | | |

U h l d h g m p es y (M y Ch se)

| | | | | | | | |
|----|----|-----------|---|---|-----|--|---|
| 6 | 38 | J h | 3 | | | | 7 |
| 6 | 39 | G m | | | | | |
| 6 | 35 | I h Am | 3 | 3 | | | 3 |
| 6 | 5 | Ge ul | 3 | 3 | o-f | | |
| 65 | | G ul | | | | | |
| 66 | 8 | S t h I l | | | | | |
| 67 | 3 | Am | | | | | |
| 68 | | Jew h | | | | | |
| 6 | 5 | Am | | | | | |

U h l d h g m p ta ry (l h wh)

| | | | | | | | |
|--|--|-----|--|----|----|--|--|
| 7 | | G l | | pe | pe | | |
| P l gr d d f m 4 se t mal p l p se t bse p l 11 mu p l a | | | | | | | |

amputation In cases in which there was oedema and in which postural drainage had been carried out before amputation the wound healed as well as when oedema had not been present The extent of gangrene is not significant except when it involves the leg and knee also Rest pain the

TABLE IV—AMPUTATIONS ABOVE THE KNEE

| Case | Age | P e | U t h g r d | C i t e s | | | Typh d | |
|------|-----|-----|----------------|-----------|-------|-------------|-----------------|-------------|
| | | | | F m l | P p l | P t t b a l | t m d m u s t d | B f e A f t |

S s s f l (M y C l a s s)

| | | | | | | | | |
|----|----|---------------------|---|-----|---|---|--|---|
| 7 | 4 | E g l h A m | 4 | 4 | | | | |
| 7 | 40 | F e h | | 4 | | | | |
| 73 | 29 | A m n | | | | | | |
| 74 | 36 | J h | 3 | 3 | | | | 3 |
| 75 | 35 | G e m a | | | | | | |
| 76 | 3 | G t l | 3 | | | | | |
| 77 | 46 | G t l | | | | | | |
| 78 | 34 | A t r | 3 | | 0 | | | |
| 79 | 34 | P l h | 3 | 4 | | | | |
| 80 | 4 | S c t h E g l u s h | | 3 | | | | |
| 8 | 48 | J w h | | p n | p | | | |
| 8 | 33 | R u s | | | | | | |
| 81 | 39 | F h | | | | | | |
| 81 | 43 | A t | 4 | | | | | 8 |
| 85 | 34 | J w h | 3 | 4 | | | | 6 |
| 86 | 6 | A m n | 4 | | | | | 0 |
| 87 | 5 | A m n i c a | 3 | 4 | | 0 | | |

S s s f l (l e s w h)

| | | | | | | | | |
|----|----|-------------------|---|-----|-----|--|---|---|
| 88 | 43 | J w h | | | 0 | | | |
| 89 | 7 | G e m a | | | | | | |
| 9 | 4 | J w h | 3 | | | | | |
| 9 | 34 | D t h E g l u s h | | p e | p e | | | 4 |
| 9 | 35 | J w h | | 4 | | | | |
| 93 | 8 | G t l | 3 | p | | | | |
| 94 | 35 | J w h | 3 | | | | | |
| 95 | 38 | A m | | | | | | |
| 96 | 56 | A m n | | 4 | | | | |
| 97 | 5 | S c t h I n h | | 4 | 4 | | g | g |

D i y e d h a l o n g (M y C l a s s e s)

| | | | | | | | | |
|----|---|--------|---|--|--|--|--|---|
| 98 | 7 | Canada | | | | | | |
| 99 | 3 | I h | 3 | | | | | 3 |

D i y d h t g (l e w h)

| | | | | | | | | |
|-----|---|-----|--|---|---|---|---|---|
| 100 | 6 | A m | | 1 | 3 | 3 | 1 | 1 |
|-----|---|-----|--|---|---|---|---|---|

L b l d h g h m p t t a r y (l e w h)

| | | | | | | | | |
|----|---------|--|---|--|--|--|--|--|
| 33 | G e t l | | 4 | | | | | |
| 33 | J w h | | 3 | | | | | |

P l a t g r a d e d f m a t 4 p r e s e n t a m l p h a t p
p e t a b s e p u l s a t i o n



Fig. 1. A case of thrombo-angiitis obliterans. After conservative measures were unsuccessful in healing the gangrenous areas resection of the lumbar sympathetic ganglia and trunks was performed. However it was finally necessary to disarticulate the second and third toes at the metatarsophalangeal joints. Through the increased blood supply provided by the previous operation the stumps healed.

varying degrees of exercise pain and the duration of the disease have no prognostic value in regard to amputation. It is possible that in a larger series of cases these phases of the subject would have greater significance.

The age of the patient has little influence on the success of amputation at different levels except in older subjects (Table V). The ages ranged from 21 to 62 years. Sixty-six per cent of the amputations were performed on patients between the ages of 30 and 44 years. Amputation was performed successfully below the knee on one patient aged 59 years. In general if the patient is past middle age amputation is more safely performed above the knee.

The predilection of the disease for Hebrews has been widely discussed. On this account race was considered. Eighteen of the 102 amputations (17.6 per cent) were performed on Hebrew



Fig 2 St mp th d week foll w g mput to

patients. Slightly less than 40 per cent of the total number of cases of thromboangitis obliterans thus far observed at The Mayo Clinic have occurred among Hebrews. The remaining 64 amputations (82.4 per cent) were distributed among patients of many nationalities. There was no variation in the healing among the nationalities (Table VI).

The significance of tobacco has been much stressed by certain writers. Ninety-four per cent of the patients in our series were known to use tobacco in varying amounts. Nothing of significance was revealed by a consideration of the amount used by the different groups.

The patency of the vessels may be of significance. There is a suggestive relationship between the extent of patency of the femoral artery and

TABLE V—AGE INCIDENCE AT AMPUTATION (BOTH GROUPS)

| A | Amp ta | B l w k | | | Abo k | | |
|---------|--------|---------|---------|---------|-------|-----------|-------|
| | | S f l | D d h l | U e f l | S f l | D d h l g | U ful |
| to | | | | | | | |
| 5 to | | 5 | | | | | |
| | | 9 | | | 6 | | |
| 35 t | 7 | | 6 | 4 | 5 | | |
| t | | | | | 5 | | |
| 5 | 8 | | | | | | |
| 5 5 | | | | | | | |
| 55 t 59 | | | | | | | |
| 60 t 6 | | | | | | | |

H gh mpu ec saary



Fig 3 St mp c e f b l t l m p t a t o

the results of healing. In the group of cases in which operations below the knee were not successful (Table III) all of the recorded femoral pulsations indicated some impairment and in two thirds of the cases the impairment was marked. This fact may be of significance and should be studied in a larger series. The popliteal artery often is palpated with difficulty. Too much emphasis should not be placed on its relationship to healing. This is demonstrated by the fact that its pulsation could not be felt in 37 per cent of the cases in which amputation was successful below the knee. It was palpable in some of the cases in which healing below the knee was not successful. The patency of the lower arteries is probably of no significance. We believe that in determining a site for amputation the femoral artery should be

TABLE VI—RESULTS ACCORDING TO RACE

| | H b | | G l | |
|------------------------------------|-----|------|------|-----|
| | C | P | C se | P |
| T l m p | 8 | 7 6 | 8 | 8 |
| S f l b l w k | 7 | 38 9 | 3 | 46 |
| D l y d h l g b e l w k | | 5 55 | 3 | 5 5 |
| U f l b e l w k e e (H h sa y) | | | 8 | 9 5 |
| S e s f l b o k | 7 | 38 | | 8 |
| D l d h l b k | | | 3 | 3 6 |
| U h l d b o k e s m t a t o (high) | | 5 55 | | |

TABLE VII—AMPUTATION IN CASES OBSERVED AT THE MAYO CLINIC

| Y | C bse d | Amp t t t M y Cl | | Amp t t l se wh b q tly | | Amp t t t M y Cl l wh | |
|-------|---------------|---------------------|-----------|-------------------------------|-----------|-----------------------------|------|
| | | C es | P f t t l | C se | P f t t l | P f t t l | |
| 99 | | | | | | | |
| 93 | | | | | | | |
| 95 | 4 | | | | | | |
| 96 | | | | | | | |
| 97 | | | | | | | |
| 98 | | | | | | | |
| 99 | 4 | | 4 | 3 | 4 | | 35 6 |
| 9 | 9 | | | | | | 33 3 |
| 9 | 8 | 4 | | | | | 33 3 |
| 9 | 8 | 6 | 33 3 | | 5 5 | | 38 8 |
| 93 | 5 | | 4 | 5 | | | 4 |
| 94 | 8 | 9 | 3 | 7 | 5 | | 57 |
| 95 | 35 | 7 | | 4 | 4 | | 3 4 |
| 96 | 5 | 4 | 7 8 | 4 | 7 8 | | 5 6 |
| 97 | 48 | 3 | 7 | | 8 | | 47 8 |
| 98 | 64 | | 8 7 | 6 | 9 3 | | 8 |
| 99 | 88 | 6 | 6 8 | | 3 | | 8 |
| T t l | 4 4 | 68 | 6 | 53 | 5 | | 8 5 |



Fig. 4 Stumps in a case of bilateral amputation. The rounded ends of the tibiae and the shortened fibulae are shown.

The salt solution test of Aldrich and McClure (29) which has been employed by Cohen and by Stern and Cohen to determine the circulatory deficiencies in the extremities did not in our experience give further information than is obtained by simple clinical study. Histamine reactions on the skin as carried out by Starr to determine the status of the superficial circulation have been used in a small number of cases. As yet sufficient study of this type has not been made in cases of thrombo angitis obliterans.

Increasing conservatism in the treatment of thrombo angitis obliterans at The Mayo Clinic may be noted in Table VII. Of the 424 cases observed from 1909 to 1929 inclusive amputations had been performed at the clinic in 68 (16 per cent) and elsewhere subsequent to treatment at the clinic in 53 (1 per cent) a total of 8 per cent. These results do not agree with the less optimistic outlook of some authors on this subject one of whom is of the opinion that most cases progress until amputation is necessary (10). Amputation in cases of thrombo angitis obliterans in The Mayo Clinic is becoming less common from year to year. The amputations performed during the 5 year period from 1915 to 1929 were 8 per cent less than during the 5 year period from 1920 to 1925. This is no doubt due to earlier diagnosis of

given greater consideration than the popliteal artery.

Treatment by means of typhoid vaccine (3, 5, 6, 8) and radiant heat was employed in many cases to improve the blood supply before and after operation. We believe that these are useful measures and that through them the success of amputation can be augmented. The vaccine might be given intravenously four or five times preceding amputation and could safely be given again 2 or 3 days after the operation.

Besides the age of the patient and the extent of the patency of the arteries of the extremities the general condition should be considered in choosing a site for amputation. The condition of the tissues at the proposed site of amputation is important also. If the muscles are greatly atrophied healing may not be satisfactory below the knee. Palpation frequently reveals a distinct change of temperature in the skin. This may be of aid in determining the site of amputation.

the disease and to a better application of therapeutic measures. The efficacy of fever therapy by means of typhoid vaccine has been well demonstrated (3 5 6 8). Furthermore in selected cases sympathetic ganglionectomy is followed by gratifying results (1). Illustrations of stumps are shown in Figures 2 and 3. A roentgenogram of stumps is shown in Figure 4.

SUMMARY

One hundred two cases of amputation in thrombo angitis obliterans were studied without establishing any criteria for determining a site for amputation. However the extent of patency of the femoral artery may be of significance. The age and general condition of the patient and the condition of the tissues at the proposed operative site are probably of significance.

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b ymp th t c g n l tomy p ph l
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d m l lt sol t n test II It p g t le
ph t with g l d d ma J Am M
A 9 4 l vi 4 5 4 8

- 3 ALLEN E V and BROWN G E Th ombo- g tu
blite s cha cal t dy f oo s H T at
m t and p gno s Ann It M d 9 8
550-557
4 ALLEN E V a d MEYERDING H W S g cal p o
d e n blite t scul d se e (th ombo
t s obl t s) po t of fo ty fi ca
S g Gyn & Ob t 19 8 xl 60-65
5 BROWN G E Th t atment f p ph ral ascui
d stu b s of th t m te J Am M A
9 6 l ix 379 383
6 BROWN G E ALLEN E V a d MAHORNER H R
Thr mbo g t Oblite Philadelph W B
S d rs Co 9 8 pp 43 49
7 COHEN M B Th nt c t lt sol t t t
p limu y po t f mple m thod f d t m
g th effi cy of th culat the e t mut
J Am M A 9 5 lxxx 56 56
8 GOODMAN CH LES a d GOTTESM N JULIUS P
d t t tm t th mbo g t obl tr s
N W Y k M J 19 3 c 1 774 775
9 MCC URE W B nd AL RICH C A f me q ed
f d s pp ance f t d m lly j t d s lt
sol tio p limu ary port f bs tuo with
p l ef to f dema J Am M As
9 3 lx 93 95
ORR T G Th mb g t blt n S th
M J 9 8 x 565 568
ST R ISAAC JR St d n th cu cul to f th
feet n d b t m llt s with d with tg gr
Am J M Sc 93 lxx 40-7
STERN W G a d COHEN M B Th int ta
lt lt wh lt t t v l d t b c f
the lt n th t mte J Am M A
9 6 lxx 355 358

NECROTIC CEDEMA OF THE GALL BLADDER

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A STUDY of the arterial blood supply to the gall bladder discloses variations in the distribution of the cystic artery which may account for many vagaries in the pathology of the cystic duct and gall bladder. Branches from the hepatic artery pass to the cystic duct before the cystic artery supplying the gall bladder divides into two or three main stems and splits up into its terminal distribution. The venous distribution is less subject to eccentric placement and empties its main stems directly into the right stem of the hepatic vein. The vascular arrangement may be greatly modified by variations to which the cystic duct is also subject in its relation to the choledochus and the lower portion of the common hepatic duct. These anatomic eccentricities have long been noted and described.

Of even greater significance in cedema from infection is the rich lymphatic arrangement. Sudler's illuminating investigation of the lymphatic distribution to the liver, gall bladder and pancreas furnished the key to the epochal researches of Graham and Peterman which followed later. Extended reports on these laboratory studies on the lower animals and at the operating table on the human subject suffering from cholecystitis and hepatitis have been widely published. They are now generally accepted by surgeons whose clinical experience in gall bladder disease justifies an authoritative opinion.

Any severe infection of the liver, gall bladder or pancreas of hematogenous or lymphogenous origin is always followed by an cedema. The intensity of this cedema by which is meant the degree of destructive change in the cells of the tissues involved will designate its nomenclature.

In our early studies of septic gall bladders little effort was made to differentiate these classifications based on any rational analysis of the pathogenesis which might be back of terminal conditions found at operation or autopsy.

They were classed as acute cholecystitis, cho-langeitis, empyema, cholelithiasis, gangrene and hydrops as the major divisions in this pathology.

When it became known that obstruction of the cystic duct resulted in infection of the mucosa and bile content in the gall bladder and that as long as this duct was patent infection could not be produced experimentally we were afforded a basis on which a truer scientific classification could be worked out.

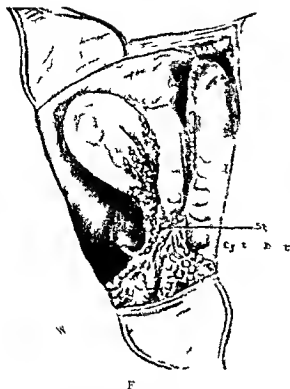
We were meeting from time to time examples of infection in which an intense cedema with mottled discoloration and great enlargement of the gall bladder showed positive blocking of the blood and lymph vessels. Sometimes these gall bladders would be empty or contain gas only and the serous surface would be streaked instead of mottled with areas which appeared to have only a partially arrested circulation. In all of these cases the gall bladder would be found covered in with more or less extensive omental adhesions in which the omentum shared in the cedema with enlarged blood vessels. In several cases some what more advanced in cedematous change pools of dark, purulent fluid would be found within the omental folds about the gall bladder. When the gall bladder was opened invariably we would find a single stone or a cluster of impacted stones firmly fixed in the cystic duct.

Rarely if ever was there found more than from a few drops to a drachm of purulent fluid within the gall bladder. Sometimes this was mixed with bile pigment. In 3 cases there was gas only. One of these had an emphysematous wall and two of them were accompanied with marked cedema of the pancreas and beginning fat necrosis. It was obvious that such destructive pathology could be accounted for only by grave interference with the circulation coupled with an intensely active infection. The firmly impacted stone in the cystic duct could not wholly account for this degree of pathology for as will be later noted this is or has been always present in hydrops in which there persist no infective phenomena.

We must likewise exclude that type of septic cholecystitis which involves inflammation of the mucosa with collection and retention of pus while the cystic duct remains transitively obstructed. In this condition the muscular and serous layers of the gall bladder are free from cedema or serious pathological change.

We felt we were dealing with an intense parenchymatous change in the entire wall of the gall bladder due to an infection of high potency, plus a positive intraductal pressure and that this destructive process though it might vary in degree and extent if not arrested by operation was destined to progress to complete destruction of the organ.

Because it is not a terminal pathological condition because it is usually diagnosed in the



state of intense oedema with islands of pre-necrotic change in a contribution published in 1919 and again in more specific detail in 1924 in the *California State Journal of Medicine* we gave it the name of necrotic oedema.

The bacterial flora as shown by Rosenow and Wilkie and confirmed by Nickel and Judd are pathogenic in the acute infections and consist chiefly of staphylococci, bacillus coli and the streptococcus viridans or some form of the green producing streptococci and also certain gram negative bacilli. These infections arise from remote foci as the appendix, apical abscesses of the teeth, follicular tonsillitis, prostatitis, sinusitis, salpingitis, endocervicitis and as was years ago shown by Cushing from typhoid infection of Peyer's glands.

The symptoms are pain and tenderness with rigid rectus and a palpable mass in the region of the gall bladder. There is rarely cholaemia. The blood examination shows a leucocyte count of 20,000 to 30,000 with a polymorphonuclear count above 85. The temperature may be from 100 degrees F to 102 degrees F, the pulse 80 to 100. If seen early the patient does not show evidences of a serious infection. We have seen a number of cases in which the high leucocyte count seemed quite out of proportion to the tempera-

ture and pulse the former being 30,000 or over and the temperature 99.5 degrees F to 100 degrees F with a pulse of 80 to 90. It is to be differentiated from acute cholecystitis which may not require operative interference by a lower leucocyte and polymorphonuclear count and absence of a dense mass in the region of the gall bladder in acute cholecystitis. There is usually a protracted history of gall bladder colic with attendant disability and confinement to bed. Associated with this paroxysmal pain there may be rigor and vomiting.

The diagnosis does not wait on laboratory findings beyond blood and urine analyses. The clinical picture is clear and sharp and to anyone who has once observed a case is typical of the acute abdomen. It is to be noted that in all cases the liver and very frequently the pancreas shares in the oedema, the liver especially in a zone several centimeters peripheral to the attachment of the gall bladder showing a granular, turgid surface and markedly thickened border.

The treatment is early cholecystectomy with drainage.

The author's first case of necrotic oedema of the gall bladder was in a patient seen through the courtesy of another physician in March 1906. There were such outstanding pathological features in the case—features which now 24 years later are so typically classical for necrotic oedema—that even at that day were believed to be worthy of record. The case was reported in the *Annals of Surgery*, July, 1908, and is now believed of such historic and pathologic interest as to justify its recital here.

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It was called in by Dr. Adams on March 1. The patient was a large plethoric subject with jaundiced skin and conjunctivae. His temperature was then 102.4 degrees F and the pulse 118 and he had had several rigors. He complained of a severe pain in the right hypochondrium which extended through to the back. The right rectus was rigid and there was a dense mass in the region of the gall bladder which was only slightly tender on firm pressure. The diagnosis was suppurative cholecystitis with localized peritonitis and immediate operation was advised. The operation was at the California Hospital on March 2.

The gall bladder which was several times the normal size was gangrenous and distended with gas. It was covered in and walled off from the peritoneal cavity by the gastrohepatic and a portion of the great omentum. Surrounding the base of the gall bladder was a pool of dark slate colored purulent fluid. The omentum was deeply injected and stained by this dark fluid. The fluid was sponged away and the gall bladder opened. It contained gas only; the walls were moist and were distinctly emphysematous, crackling under pressure between the thumb and finger. The mucosa easily separated from the wall and both were gangrenous.

In the upper portion of the cystic duct was an irregular stone about the size of a small hazelnut imbedded in sand and gravel like millet seeds. No other concretions were found. The common and hepatic ducts were probed and found clear. The gall bladder was freed of further adhesions and removed; a drain being placed in the remaining portion of the cystic duct. A pocket above and one below the former position of the gall bladder were drained with cigarette drains. The convalescence was not marked by any unusual incident and the patient left the hospital March 6. A slight mucous discharge continued for several weeks from the drainage fistula.

The feature of especial interest in this case is the emphysematous condition of the gall bladder wall and the distention with gas of the bladder itself. Of the bacterial flora present little can be said as the material taken for smear and culture was accidentally destroyed. One might assume the presence of coli probably the commonest form of gas producing bacillus incident to the gall bladder.

In this report of a patient operated on almost a quarter of a century ago for what was then diagnosed as gangrene of the gall bladder we were conforming to the classification current in the surgical literature of the time. Up to the time of this report and until some years later we had not seen a case of true gangrene of the gall bladder and had accepted the nomenclature of the authorities of that day. We have the conviction that much of the nomenclature of the pathology of the liver, gall bladder and pancreas needs revision. Classifications more in consonance with the newer interpretation of this pathology would be of very real value to the clinical surgeon.

It is an accepted principle in pathology that all reticulo endothelial structures take on oedema in the presence of infection or other chemical irritation which may give rise to cloudy swelling. This oedema in the early stage may not be destructive. If the cause is removed and the patency of the blood and lymph vessels re-

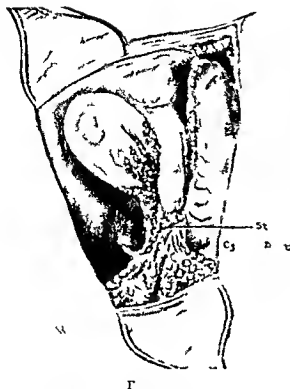


Fig. 2

established the oedema will subside and function be restored. In the case of the gall bladder a branch of the cystic artery may still be patent and the portion of the gall bladder fed by it remain fairly well nourished while in other portions the blood supply may be blocked by pressure from within the cystic duct and by the oedema which accompanies it. The oedema may be even subacute as well as partial embracing a portion only of the viscus.

In true gangrene of the gall bladder the entire blood supply is definitely cut off and there is a corresponding block of the lymph system. The state of oedema has passed to one of absolute necrosis and the viscus takes on a limp, moist, slate colored aspect attenuated in texture and wholly devoid of life. The author has seen but one case of true gangrene of the gall bladder and it is a pathological picture never to be forgotten.

As long as the afferent and efferent circulatory streams are functioning gangrene cannot occur. In most of these cases of necrotic oedema which we see there are areas in the gall bladder wall more or less normal in appearance which are still being fed by blood vessels and drained by lymph vessels. In all of these cases there are extensive adhesions between the serous coat and highly vascular folds of omentum which have formed an anastomosis and serve to keep alive the gall bladder wall. It has been clearly demonstrated that feeder capillary shoots are also projected from the liver when the hepatic oedema is not intense which in like manner contribute to the



state of intense œdema with islands of pre-necrotic change in a contribution published in 1919 and again in more specific detail in 1924 in the *California State Journal of Medicine* we gave it the name of necrotic œdema.

The bacterial flora as shown by Rosenow and Wilke and confirmed by Nickel and Judd are pathogenic in the acute infections and consist chiefly of staphylococci bacillus coli and the streptococcus viridans or some form of the green producing streptococci and also certain gram negative bacilli. These infections arise from remote foci as the appendix apical abscesses of the teeth follicular tonsillitis prostatitis sinusitis salpingitis endocervicitis and as was years ago shown by Cushing from typhoid infection of Peyer's glands.

The symptoms are pain and tenderness with rigid rectus and a palpable mass in the region of the gall bladder. There is rarely cholæmia. The blood examination shows a leucocyte count of 20,000 to 30,000 with a polymorphonuclear count above 85. The temperature may be from 100 degrees F to 102 degrees F the pulse 80 to 100. If seen early the patient does not show evidences of a serious infection. We have seen a number of cases in which the high leucocyte count seemed quite out of proportion to the tempera-

ture and pulse and the temperature was 100 degrees F with differentiated leukocytes and presence of a dense bladder in acute a protracted history attendant disassociated with rigidity and von

The diagnosis is made by the picture beyond blood picture is clear has once observed abdomen. It is to liver and very frequent the œdema the liver centimeters peripheral gall bladder showing and markedly thicker.

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vitality of the threatened gall bladder wall. Only in those fulminating highly infected types of oedema do these auxiliary factors in conserving the life of the gall bladder fail. The case reported in this paper is one of these and only immediate operation can arrest the progress of such a destructive change from its lethal termination in true gangrene.

Although it is too hazardous to predicate a justification for delay in operating upon these patients it is certain that some of them do recover without operation as contracted gall bladders abundantly testify. No gall bladder ever can contract down to half or third its normal size as we frequently see without a definite substantive inflammatory change having taken place antecedent to this contraction. A carefully taken anamnesis will invariably disclose the history of one or many acute attacks of cholecystitis with a typical syndrome of cholelithiasis infectiva. These are cases not of so called empyema—pus in the gall bladder with an infected mucosa—they are cases of infection of all the layers of the gall bladder wall but in which there is sufficient blood supply remaining to save the viscus from entirely perishing. The stone which obstructs the cystic duct and by its transitory pressure blocks the blood and lymph stream is not so firmly impacted but in time it will work its way back into the antrum of the gall bladder and the pressure obstruction of the vessels is then relieved. Through the repetition of these attacks the oft repeated inflammatory seizures cause the wall in time to contract down on the imprisoned stones to a size less than one half the normal.

A very different clinical picture obtains in septic cholecystitis with pus in the gall bladder. This may be and frequently is a transitory phase of partial obstruction of the cystic duct with the usual sequence—which Peterman's experiments proved with such conclusive data—the infection of the fluid contents of the gall bladder and the mucosa. The submucous reticular area, the muscular coat and the serosa do not share in this infection and it may and very frequently does have but a casual prognostic significance. For when the obstruction is relieved the pus drains away and the mucosa is largely restored to its normal function. At no time in this empyema was the vascularity of the gall bladder obstructed. At no time were the other coats of the wall found to be oedematous from blocking of the lymphatics. At no time was necrotic oedema or its terminal expression true gangrene threatened.

It is true that over a prolonged period of successive attacks of septic cholecystitis the reticular cells in time may become greatly thickened and these dense gall bladders become foci which may perpetuate a chronic hepatitis which will result in grave cirrhosis. Since Babcock's observations were published years ago we have known what a serious change in the myocardium and tax on the heart may attend these cases of hepatitis from recurrent septic cholecystitis. These are all cases demanding early extirpation of the gall bladder preferably after subsidence of the syndrome. The destiny of most cases of this type of gall bladder if not removed early is hydrops.

No greater proof can be offered of the correctness of the argument in this differential pathology than the integrity even though modified of the mucosa in hydrops. The mucosa of the cystic gall bladder goes on secreting mucus as long as the distended wall will retain it. All of these cases give a prolonged history of successive attacks of septic cholecystitis. All of them have a thickened fibrous wall as a result of years of recurring inflammatory reactions from repeated infections and increase of connective tissue. Finally the cystic duct becomes permanently closed from stricture the gall bladder fills with mucus and is henceforth in this terminal state practically immune to future infection or inflammatory change.

Why does this pathological process of successive infections never terminate in necrotic oedema or in gangrene? During the prolonged process of the rise and fall of successive infections as obstruction in the cystic duct came and went the deposition of connective tissue was confined largely to the submucous reticulum leaving the blood and lymph vessels substantially free from obstruction.

These infections are at no time associated with the phenomena of a fixed oedema; they are a local mucous and submucous invasion and go through none of the changes which characterize a general mural oedema.

Until it was demonstrated by a long series of experiments on laboratory animals and by observation at the operating table of the living pathology in the human subject the phenomena in the mural and parenchymatous infections resulting in the varying degrees of oedema had remained uninterpreted.

SUMMARY

All acute and subacute infections in the liver, gall bladder and pancreas are associated with oedema.

Infection of the gall bladder is a transitory invasion confined to the mucosa and submucosa as long as the blood and lymph supply are not definitely blocked.

Necrotic oedema is a definite pathological condition in the gall bladder and cystic duct due to a more or less complete blocking of the blood and lymph stream from infection and from obstruction of the cystic duct. It is characterized by a peculiar symptomatology and blood picture and

by destructive changes in the tissues resulting from a fixed oedema.

Septic cholecystitis either acute or subacute is not to be confused with this either in symptomatology, or pathology immediate or remote and it has a terminal destiny in no way resembling necrotic oedema.

All persistent destructive infections of the gall bladder not associated with pancreatitis call for early cholecystectomy with drainage.

CORRESPONDENCE

AN HISTOLOGICAL STUDY OF THE PERI VAGINAL FASCIA IN A NULLIPARA

To the Editor With Dr Bissell I was much interested in the paper on perivaginal fascia in nullipara by Dr Byron H Goff in your issue of January 1931 and interested especially because I have long taught that there is no true fascia between the bladder and vagina as commonly believed. Dr Goff states a careful search through the literature has failed to reveal any previous attempt of a similar nature (that is sectioning) with the exception of a study by Spaulding (1926). In the first edition (1910) of my *Principles of Gynecology* and in all subsequent editions photomicrographs are shown of sections through the anterior vaginal wall and bladder and the posterior vaginal wall and rectum and the various structures are indicated. No fascia is mentioned only vaginal muscle. I imagine I was the first to assert this fact and my knowledge was obtained not only by these complete sections from a nulliparous woman but also from material removed at operation. If this should catch his eye Dr Gray Ward will remember I am sure that about ten years ago when I was performing a colporrhaphy and he was present I insisted that the tissue in question was *involuntary muscle*. I gave him a piece and asked him to have it sectioned and stained by van Gieson's method. This he did and I believe he has since been convinced of its nature

I have in so many publications stated the character and origin of this muscular sheet—that I hesitate to do so again. Briefly it is derived from the external muscle coat of the uterus and is the counterpart of the uterosacral muscles (ligaments) behind. It is perforated by the urethra just as the posterior muscle layer is perforated by the rectum.

There are many points of interest especially in regard to the development and arrangement of the vaginal musculature itself which I cannot discuss here.

W BLAIR BELL

Liverpool England

HYPERPLASIA OF THE ENDOMETRIUM AND THE HORMONES OF ANTERIOR HYPOPHYSIS AND OVARIES

Dr C F Fluhmann of San Francisco has called our attention to the fact that in publishing his article entitled *Hyperplasia of the Endometrium and the Hormones of the Anterior Hypophysis and the Ovaries* in the June 1931 issue we have transposed the parts of Figure 12 so that the section showing the findings in the control animal have been given in the plate as the experimental result and vice versa.

We take this means of correcting our error which we regret exceedingly.

THE EDITORS

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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SEPTEMBER 1931

THE MEDICAL TREATMENT OF INOPERABLE MALIGNANT DISEASE

In malignant disease in the human body it is not uncommon to find evidence of inoperable lesions but without direct evidence as to the site of the primary lesion. This is particularly true in the abdomen. If in doubt one frequently can remove under local anesthesia a small bit of tissue for microscopic examination in order to make sure that malignant disease actually exists and sometimes the specimen examined under the microscope will show by its cell characteristics the probable source. In the desire to make an exact diagnosis the patient may be unnecessarily put through a number of time consuming tests attended by discomfort and expense or he may even be subjected to exploratory incision when the essential fact that the disease is malignant and incurable is already known.

There are certain characteristics for instance of general abdominal carcinomatosis which can be recognized in a short examina-

tion by palpation and inspection and which show that the condition is malignant and inoperable although the primary focus of the disease may not be known. The presence of carcinomatous glands in the supraclavicular space usually on the left side is evidence that carcinoma of the stomach probably exists. In case of doubt under local anesthesia a section of a gland can be removed for microscopic examination without subjecting the patient to various less decisive tests.

We may find the so called button umbilicus which so frequently results when the peritoneum is involved by malignant disease in the vicinity of the stomach. The hard congested umbilical area will give the diagnosis and the prognosis and again in such a case if there is doubt a little piece of tissue can be removed for microscopic examination.

Moreover carcinomatous cells detached from the involved peritoneum over the affected area may gravitate to the pelvis and become attached in either sex to the epiploic tags on the lower part of the sigmoid at the bottom of Douglas pouch. The examining finger introduced into the rectum comes in contact with this shelf like or signet ring characteristic which usually does not involve the mucous membrane. Sometimes this mass will surround the whole of the middle and upper parts of the rectum. In such cases the diagnosis and prognosis are evident. Implantation of carcinoma cells in the ovaries by gravitation from higher lying lesions is common.

The presence of free fluid in the abdomen is a diagnostic and prognostic hazard for a positive opinion unless nodules can be felt on

ballottement. If there are other tangible evidences of inoperable malignant lesions in conjunction with the ascites, an exploratory incision may be unnecessary. In the absence of jaundice, the differential diagnosis between carcinoma with free fluid and cirrhosis of the liver can sometimes be made by Rowntree's test of hepatic function.

In this connection we must not forget that benign solid tumors of the ovary, fibromyomas in nature, are sometimes the cause of accumulations of fluid in the abdomen. Tumors of this kind can be readily felt on bimanual examination and usually occur among women who are otherwise in good condition. The symptoms caused by these growths are quite different from those caused by the common secondary types of carcinoma of the ovaries which are due to the implantation of malignant cells, usually in ruptured graafian follicles, which form large indefinite mucoid masses in the abdomen. The solid benign tumors are readily removed and the patient remains well. It is true that in carcinoma of the ovaries the cystic colloid masses can sometimes be largely removed by operation. If removal is followed by radiotherapy, the growth may be delayed for a long time and in some cases patients can be carried along for a number of years by repeated surgical removal of the cystic masses followed by radiotherapy.

There is one exception to the inadvisability of radical operation for incurable cancer and that is removal of the primary growth when secondary growths are present in certain situations, for instance in the liver. The liver has the greatest power of regeneration of any organ in the human body. In three operations, several months apart, the entire liver of a dog can be removed, as shown experimentally by Mann, with eventual complete regeneration. When cancers of the stomach, the rectum and

the large intestines are safely removable locally, it is sometimes advisable to excise the primary growths as a means of palliation and to prolong life, thus enabling painless secondary processes to bring about the fatal issue. Especially is this true of metastatic growths in the liver. Metastatic processes in the liver have plenty of room for enlargement without infecting or pressing on neighboring organs, nerves and tissues, and the patient may live many months comfortably and die painlessly. During the last few weeks of life, the patient usually is jaundiced but without severe pain. It has been pointed out by specialists in tuberculosis that if the primary lesion can be removed or cured, the secondary lesions are more readily cured or delayed in advancement than is the primary lesion. This may also be true of malignant disease. W. J. MAYO

ACUTE EMPYEMA OF THE GALL BLADDER

THE time and type of operation in acute empyema of the gall bladder has been a subject of controversy second only to that of the acute appendix of former years.

The infection originates as a localized process in the gall bladder. Perhaps in every case the cystic duct or pelvis of the gall bladder (Dennis) is first obstructed. The obstruction interferes with the circulation of the gall bladder. This interference with the circulation is due; it would seem, to a direct pressure on the cystic artery by the obstructing body.

It is possible that a kink, stricture, or other cause may initiate gangrene or acute empyema of the gall bladder but, at least in the great majority of cases, stones are the cause of obstruction.

Passing from the gall bladder to the common duct, the distance between the cystic duct and artery gradually increases. Therefore a stone in the pelvis of the gall bladder

or in the distal end of the cystic duct would be more likely to produce pressure on the cystic artery with resulting empyema or gangrene of the gall bladder than one in close proximity to the common duct

Not only is the circulation impaired by the obstruction to the cystic artery but a stasis is created in the gall bladder. Bacteria may be already present in this organ or may reach it through the lymph stream. Stasis in any organ favors the development of infection. Bacteria in the presence of stasis and an impaired circulation creates the favorable setting for the development of an acute empyema of the gall bladder. The development of the infection may be rapid and a severe condition may develop early resulting in severe empyema or gangrene or it may come on more slowly and again tend to subside. From the general symptoms our judgment may tell us whether to expect the one or the other.

This condition usually occurs in those who have had repeated attacks of gall stones with varying intervals but occasionally it accompanies the first attack. When an attack comes on which persists with the development of fever possibly chills severe pain at the right costal margin a high leucocyte count and frequently later a rigid abdomen we should suspect this condition. Halsted called attention to the fact that the liver edge may be pushed forward so that it may be palpated below the costal margin. In this case the gall bladder is ballooned out well beyond the edge of the liver.

If allowed to progress the inflammatory process may produce pressure upon the common duct thereby causing obstruction and a resulting jaundice. Once the process extends to surrounding tissues pathology is created which may never be satisfactorily removed.

In the treatment of this condition three methods of procedure are open to us (1) Shall

we do a cholecystotomy and drain out the infected material? (2) Shall we wait in the hope that the process may subside and operate later when the patient has built up a resistance? Or (3) shall we do a cholecystectomy and thus remove the entire gall bladder and its infected contents?

To turn loose this recently developed virulent infection in the large open wound communicating with the peritoneal cavity does not seem advisable. Is it possible here to do a cholecystotomy and not contaminate the wound and peritoneal cavity? This operation no doubt has given a high mortality. If the patient recovers from the infection in the wound and peritonitis there usually remain many disagreeable adhesions between the gall bladder and neighboring organs. In a large percentage of these cases a later and more difficult operation is necessary to remove the diseased gall bladder.

In the presence of very severe early symptoms to delay is usually to court disaster. If there is sufficient pressure on the cystic artery the gall bladder usually becomes gangrenous. Gangrene usually leads to rupture of the gall bladder accompanied by severe shock, usually multiple abscesses especially subphrenic peritonitis and a very high mortality.

A cholecystectomy removing the gall bladder with all the infected contents would be no doubt the ideal operation provided this may be safely accomplished. Unless early severe symptoms are present severe empyema or gangrene does not usually occur. With the symptoms mentioned coming on early an upper abdominal surgical condition should be at once seriously considered. If symptoms continue to advance and the location of the pathology is reasonably certain surgery should not be delayed. With our recent refinement of technique and knowledge of block anesthesia the liver gall bladder and ducts

may be brought well up into view and the entire mass of infection may be removed with little danger of contamination. As soon as the opening is made through the abdominal wall all other abdominal contents are well packed off with hot packs. The gall bladder is usually so distended and friable that it should not be handled with instruments. It may be handled with gauze in the gloved hand or the liver may be lifted up and turned forward until the cystic duct proximal to the obstruction may be grasped with the fingers and when sufficiently isolated from neighboring structures clamped with forceps. Early the cystic duct proximal to the obstruction shows little evidence of swelling, œdema, necrosis or the severe inflammatory condition present distal to this point. There is usually sufficient space to double clamp the duct so that it may be severed here without danger of escape of the virulent infection. By dividing it here and gently peeling out the distal portion of the

cystic duct and the gall bladder we have removed the source of trouble. Even in the most severe cases it is often amazing how rapidly the symptoms will subside if the operation is carried out without a break in the technique. The patient frequently recovers as rapidly as the one in whom a simple chronic gall bladder has been removed. A small rubber drain is usually inserted but usually there is no drainage if the operation is very carefully done.

The anæsthetic used here is important. It should insure relaxation so that the structures may be brought well up into view and also quiet that the operator may not be molested by intra abdominal pressure. Spinal anæsthesia well administered gives excellent results. Local infiltration of the abdominal wall with anterior splanchnic anæsthesia (Braun) if successfully administered gives all that could be desired of any anæsthesia.

JAMES M. HAYES

MASTER SURGEONS OF AMERICA

JAMES ALEXANDER HUTCHISON

DR HUTCHISON was born in Montreal and received his early education at the Montreal High School. His parents then moved to Goderich, Ontario, and there he attended the Goderich Collegiate Institute from which he passed to McGill University.

He graduated from the Medical Faculty of McGill in 1884. At the time that he graduated he had not quite attained his majority and went to Edinburgh for further study and obtained the degree of L.R.C.P. & S. (Edin.).

On returning to Montreal he began as a general practitioner. In 1891 he was appointed surgeon to the Out-patient Department of the Montreal General Hospital, and in 1894 became full surgeon, which position he filled until 1914.

Dr. Hutchison was appointed demonstrator in clinical surgery in McGill University in 1898 and was made associate professor in surgery in 1913 and eminent professor in 1923.

As a surgeon Dr. Hutchison was highly esteemed by the profession and trusted and loved by his patients. He was a painstaking diagnostician and a careful almost meticulous operator, and his results would bear the closest scrutiny. As a consulting surgeon he was in demand over a wide area.

Dr. Hutchison taught surgery to the students of McGill for twenty-six years. His bedside clinics in the wards of the Montreal General Hospital were models of bedside teaching. He had a gift for inspiring in students an inquiring mind, careful observation, and care in reaching logical conclusions. He taught them how to examine patients without inflicting unnecessary pain or discomfort. His cheerful manner and gentle ways were an object lesson to his students which were never forgotten. His theater clinics were clear, always to the point, and so carefully prepared that his class always dispersed feeling that they had got something to hang their hat on. It is to be noted that with all his outside interests it was only on the rarest occasion that he missed a clinic or lecture, and never without timely provision of a substitute. He was always highly esteemed by the student body.

For thirty-five years Dr. Hutchison was chief medical officer of the Grand Trunk Railway and of the Canadian National Railway into which the Grand Trunk was merged. It was a great responsibility. It meant the appointment and supervision of a large army of district surgeons, the organization of a pension fund



J ALEXANDER HUTCHISON
1863-1929

provision for first aid in emergencies, and the consideration of the many claims made against a railway for real and imaginary injuries. In the settlement of these claims he had an almost uncanny faculty due I think to his thorough investigation and determination of the facts and to his fair and judicial mind. In this field he won not only the confidence of the railway officials but that of the courts. He always had a loyal following in his district surgeons. He treated them fairly and they in their turn were faithful to their chief.

Dr Hutchison was twice married first to Jessie Caverhill who died in 1899 leaving three sons and one daughter Mrs Edmund Newcombe. One cannot speak in too high praise of Dr Hutchison as a father. He made intimate companions of his sons and his daughter and three more manly and honorable young men and a more charming wife and mother than his daughter are not to be found.

In 1902 he married Jane Purdy who survives him.

Before the war Dr Hutchison was made Hon. Associate of the Venerable Order of the Hospital of St. John of Jerusalem for his work in stimulating First Aid.

Dr Hutchison had a truly enviable war record. In February 1916 he was sent overseas to prepare for the Canadian Government a special report on the re-establishment of wounded and disabled soldiers. On the completion of this report he joined the Canadian Army Medical Corps as Surgeon to No. 1 Canadian General Hospital at Etaples in June 1916. In April 1917 he was appointed chief surgeon at Moore Barracks and in May, 1918 was made consulting surgeon to the Canadian Forces in England which post he occupied until the close of the war.

Dr Hutchison's three sons served as combatant officers for the duration of the war and although two of them were wounded one of them twice they recovered and father and sons returned home alive and comparatively well.

In appreciation of his services in the Army Medical Corps he was made a Commander of the Order of the British Empire on the recommendation of the War Office.

Dr Hutchison contributed the article on Railway Surgery in *American Practice of Surgery* by Bryant and Buck and also valuable surgical papers to Canadian and American medical journals.

He was local secretary of the British Medical Association at its meeting in Montreal in 1897 a Fellow of the American Surgical Association and Fellow of the American College of Surgeons.

Dr Hutchison was fond of horses and in his earlier years always had a fine pair. He is greatly missed in professional and social circles. He was a genial and entertaining companion with a great sense of humor and an attractive personality.

GEORGE E. ARMSTRONG

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

ALFRED BROWN M.D. F.A.C.S. OMAHA

MARCO GATINARIA—CONCERNING THE CURE OF INDIVIDUAL DISEASES

MARCO GATINARIA belonged to the comparatively small group of medical men who practiced and taught medicine and surgery during the latter half of the fifteenth century. These men have largely been neglected by historians and have been given little importance in the development of surgery. They lived at a period when the world might be said to be catching up with itself. The discovery of printing from movable type in the middle of the century had set a great number of printers and publishers to work printing the works of the ancients which had been the standards of knowledge for centuries. If the contemporary writer was to get anything printed he must base his work upon something that the world knew. Otherwise the printers and publisher usually and the same had no use for it. Consequently we find at this period nearly all the medical works purporting to be commentaries on some book of the famous ancient writers. The title of the book does not mean however that there is nothing new or original in it. It does mean that in order to get the work printed at all the author was forced to refer to an ancient. As Malgaigne says of Gatinaria: "Gatinaria described the syringe under the name of an instrument for a clyster and he even considered it necessary to illustrate it by a figure but like the majority of the authors of this epoch he did not dare to introduce so great an innovation in practice on his own authority and took refuge behind Avicenna." So he says gave a description on which has been poorly understood by many. This declaration of the modest author however compels us to say that there is nothing similar to it in Avicenna. Darenberg challenges this statement but his challenge does not seem to take into account the clearness and originality of Gatinaria's description of the instrument for all intents and purposes a double current rectal irrigator.

Marco Gatinaria is supposed to have been born at Verceil and to have practiced his profession in the last half of the fifteenth century both in Milan and Pavia. At the time of his death in 1496 he was professor at the University of Pavia. Beyond these few facts nothing is known of his life. He wrote his work in 1466 but it is not published until 504, eighteen years after his death. Following the custom of his contemporaries he calls it "Concerning the

cure of individual diseases or an exposition of the new books of the Al Mansori.

As one would expect the work is largely medical but here and there interesting surgical points are given. His illustration (q.v.) of the double current colon irrigator is probably the first illustration of this instrument in the literature. It is doubtful however if it acted just as Gatinaria thought it did. His idea was that colic was due to air which could not get out of the bowel. Consequently as water was forced through one nozzle of the syringe the air would be forced out of the other.

As surgical procedures he advises aspiration in ascites frequently speaks of phlebotomy and recommends lithotomy for stone. Though he advises local applications for proclivencia he says "And I have seen a woman having the uterus hanging between the thighs who lived many years after having the putrefactive part cut away." The most interesting surgical discussion is that of hernia. Gatinaria says for the cure of this there are two noteworthy intentions. The first is the reduction of the intestine to its site. The second is the retention of the intestine to its proper place and the consolidation of the break or dislocation. To carry out reduction the hips are raised and applications made to reduce the swelling of the contents of the sac. The manipulation of the sac must always be gentle. The second intention on retention of the intestine he accomplishes either with a ligature or bragerius (a truss?) which compresses the place lest the intestine descend. It is interesting to note that he mentions (ligature) first and then says for retaining the consolidation the ligature alone suffices often in infants. One question is if by ligature he means a ligature of the neck of the sac or some sort of yarn truss over the swelling and by bragerius literally breeches an external appliance. Further on he notes that some cauterize the place of exit others make an opening and close the point of exit with gold wire and still others perform castration on cauterize the site of hernia and allow it to heal with a firm scar. He refers to a blacksmith in Saint J. Anne who makes iron brages and which are the best he knows of and which had helped many. He notes facial vomiting and also umbilical hernia. A note concerning a certain woman whom I saw who was ruptured when she labored in childbirth and the intestines protruded and made a great tumor in the umbilicus.

**Marcus Sannane de curis egri-
tudinū particulariū noni Al-
maſonis Pratica vberima.**

**Notabile & breue Introductorium p̄dricæ
de febribus Gentilis de fulgineo vltra
ea que in hoc volumine per alios impressa
sunt nouiter in lucem habitum.**

**Blasij Aſtarij de curis febrilium libellus
vtilis**

**Cesaris Landulphi de curis earūdem opu-
ſculum.**

**Sebaſtiani Aquilani Tractatus de morbo
Gallico celeberrimus**

Eiusdem queſtio de febre ſanguinis

Forma enematis. Fluxus cereb'alis

Hec eſt forma cluſteris qua nō intelligit multū & quā de
ſcribit Hic ſi q̄ pars ſuperior. ſ. cana eius ſit dupla ad
partē inferiorē & mediet̄ inter has partes mediū vno ſicut pa-
ris obſcure partes illas ſicut eſt in duabus ſiſtulis coniun-
ctis & habeat pars minor vno ſoramen in parte q̄ eſt p̄p̄e cō-
iunctionē huius cluſteri & alius in oppoſito vircute ſim ſegu-
tudinē q̄ ſit apud ſoramen partis groſſic. iō per qua partes
maiores cui cōſignatur maxime buſa tranſeat aquoſitas ene-
matis impoſita per vitrem per inferiores vero cānam ſine in-
notem pulſa ab enemate veniſſate per vitreis cōpreſſionem
ipſa ventroſitas egreditur & hoc patet in figura & reddent di-
cta cum cauſa litterarū cluſteri obſcuram claram &c



Cura fluxus cereb'alis

Nota primo q̄ in cura fluxus talis ſeruabit ordo q̄ in
particularib' ſpeciebus fluxus particularis ponitur
cura q̄ iſta materia fluxus eſt mare magnum & non poteſt vna
cura tota caſuarindeo ſicut dictū eſt ſuccente & ordinate po-
nent̄ cure ſingularū ſpectatū & primo fluxus cereb'alis q̄
prouenit vitio cerebri & eſt ex eo q̄ aliqua materia ſalia acuta
vel pungitua deſcendens a cerebro & hoc per catarrhos plu-
rimos ſtimulat & irritat virtutē expulſiua ſtomachi & ita en-
te digeſtionē cōpleta cū virtus conſt illa expellere vel etiā
multi catarrhi humidi humectādo ſufficere intrinſeca ſtomā-
chi ratione rariū puenit quēdā lubricitas & ita debilitat con-
ſtentia quare cibū nō pōt in ſtomacho cōſterni debito tpe
ſicut ſi morbus eſſent inuncte oleo & iudice ſarte non poſſent
debite cōſternere. Signa iſtus fluxus ſunt catarrhi præcedentes
vel actualiter exiſtentes vel etiā q̄ exiſtent fluxus iſte rēpore
pluuiſo vel ſi p̄ ſomnu longū ex eo q̄ in ſomno longo rati

REVIEWS OF NEW BOOKS

WHILE a great deal of useful information pertaining to the treatment of injuries is packed into Moorhead's *Traumatotherapy*¹ the reviewer is left with a feeling of regret that the author did not adhere to the plan so admirably carried out in his *Traumatic Surgery*. The plan of the present book is that the symptoms and diagnosis of most of the traumopathies are apparent from the history or become so on inspection or by the aid of X rays or other routine laboratory aids and therefore he has devoted the volume to the treatment.

The subject of splenectomy is covered in 11 lines and the only symptom mentioned in making the diagnosis is pain in the left shoulder. Two hundred and thirty-two pages are devoted to the treatment of fractures. No mention was discovered of the employment of intravenous glucose solution in the treatment of skull fractures. Carbuncles and boils are considered under the same heading and the statement is made that crucial and similar needless procedures are to be condemned. One regrets seeing in a modern textbook the illustration advocating through and through drainage across a finger in suppurative tenosynovitis and the statement that all animal bites should be vigorously cauterized might be taken exception to. The reviewer feels that the tannic acid treatment of burns deserves more than 14 lines. The author is in favor of flooding the wound with 7 per cent tincture of iodine and does not take up the newer antiseptics mercurochrome metaphen etc. Bacteriologists might question the statement that germs will not appear in any wound until after 6 to 12 hours thus this interval is the accepted time of wound salvation.

The paper and printing are excellent and the illustrations numerous and interesting.

THE monograph entitled *Les Tumeurs Cérébrales*² is really a detailed report of the first 4 months of activity of the Neurosurgical Institute of Paris. In it the authors have presented abstracts of all the cases of intracranial tumors operated upon in that time with detailed reports of the most characteristic ones. It is apparently a good review of the present state of neurologic surgery in France. A plea is made for better co-operation with the specialties especially otology ophthalmology and radiology as they relate to neurology and neurologic surgery. The operative mortality of the cases reported (8 per cent) impresses one as being rather high as compared to similar statistics from American clinics. Written as the authors state with the design of revealing the necessity for early diagnosis and adequate surgical treatment of intracranial neo-

plasms as well as to inform the general practitioner of medicine what can be accomplished in these conditions it admirably fulfills its purpose.

HALE HAVEN

THE authors of *Surgical Diagnosis*³ have brought together a most comprehensive and exhaustive work. It is the first work of its kind to embody all that is known without neglect of the still important clinical side of diagnosis. In his preface the editor states the strictly clinical phases of the subject have been emphasized but not to the exclusion of those methods of laboratory examination which seem to the editor and contributors to be useful and practical. The method of presentation is indicated by the statement an effort has been made to construct a work which will be helpful not only to the surgeon but to his medical colleagues as well.

Most topics are introduced by discussion of anatomy physiology and etiology. In view of the fact that these three volumes represent a compilation of fifty monographs by almost as many men the uniformity of presentation is amazing. By this we mean both the structure and the discussions as well.

Volume I deals with wounds infections post operative complications blood vessels extremities hand infections bones joints and spine. Approximately three fourths of this volume is given over to the extremities a large section of which is devoted to the diagnosis of fractures.

Volume II covers gynecology skin face mouth and jaws neck stomach duodenum peritoneum small intestines colon spleen hernia and acute abdominal emergencies. The chapter on gynecology is an excellent textbook like presentation. The same may be said of the chapter on face mouth and jaws topics on which there is usually but scant information to be obtained from the average text.

The chapters on stomach and intestinal tract contain fine discussions on function.

Volume III considers thorax breast liver and bile passages pancreas rectum and anus genito urinary surgery and there are five chapters dealing with neurologic surgery. The outstanding chapters in this volume both written by the editor are those on thorax and bile passages. The chapters on neurologic surgery covering the central nervous system peripheral nerves sympathetic system and psychoses give a comprehensive review of neurosurgical diagnosis.

All three volumes are profusely and well illustrated. This work on diagnosis edited by Graham deserves the highest recommendation. It is the opinion of the reviewer that it embodies the finest work of its kind ever published.

J. R. BUCHBINDER

T M TH V T NT TI I J B J H J
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ATTRIBUTE to the popularity of this compact volume is the fact that it has gone through ten editions since it was first brought out by Walter Pye in 1884. During this time it has been revised by Pye, Clifton Greene, and most recently by the late Herbert Carson. The book makes a very favorable impression upon the reviewer who feels that it most ably serves its purpose of describing the details of surgical work as it appears from the point of view of house surgeons and dressers in surgical wards. It also contains a great deal of valuable material for the general practitioner. Its well illustrated and well written pages cover the field of hæmorrhage, splint fracture, and dislocations, wounds and burrs, venereal diseases, minor surgical procedures, certain diseases of the ear, nose and throat, surgical and general emergencies, and the administration of anesthetics.

Especially to be commended are the sections on the control of hæmorrhage, blood transfusions, fitting of trusses, splints, masage, dressing of wounds, Carrel-Dakin treatment, tannic acid treatment of burns, catenization, injection treatment of varicose veins, the chapter on treatment of the teeth, and the section on anesthesia.

Unfavorable criticism may perhaps be directed to the insufficient emphasis of the clavicular cross treatment in fractures of the clavicle, the type of splint used in olecranon fracture, inadequate discussions of tenorrhaphy, hot fomentations, boils, the type of operation recommended for ingrown toenails,

and the failure to recommend hypertonic glucose solution in head injuries. Excision of the eyeball seems to be too extensive an operation to describe in this book. A more complete discussion of averted anasthesia would be welcomed.

FREDERICK CHRISTOPHER

THE practical and explicit advice contained in the pages of Wilson's book² on fractures quite evidently emanates from a man who not only has had a great deal of experience with fracture, but also has done very excellent work. The author stresses the employment of the fluoroscope in reduction of fractures, and the many X-ray illustrations furnish abundant evidence of the value of this instrument in his hands. Apropos of splints he says, leaving out the Thomas splint, the rest for the most part may all be relegated to museums or the scrap heap because in plaster of Paris we have a material which is ideal in almost every particular for the making of splints. He is rather conservative in the employment of early physiotherapy; the Sayre dressing for clavicle fractures is condemned; his fluoroscopic fracture table is ingenious and practical.

In the next edition it is to be hoped that the author will have more illustrations, exclusively of X-rays, that he will show the application of the clavicular cross splint in clavicles, that he will picture the overhead traction treatment of femur fracture in children, and that he will show the aeroplane splint with traction attachment for fractures of the humerus.

FREDERICK CHRISTOPHER

Pyke, S. C. H. W. C. R. T. M. N. S. T. A. V. T. A.
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J. B. (T.) F. R. C. S. (E.) F. A. C. S. N. Y. k. Th. M. W.
C. m. p. 93

BOOKS RECEIVED

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ANNUAL REPORT OF THE REPORTS OF THE COMMISSION
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DIGESTS OF MEDICAL LITERATURE A CLINICAL AND PATH
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CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

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PRELIMINARY PROGRAM FOR THE NEW YORK-BROOKLYN CLINICAL CONGRESS

THERE is presented in the following pages a preliminary program for evening scientific sessions as prepared by the Executive Committee of the Congress. The presidential meeting on Monday evening, general scientific sessions on Tuesday, Wednesday and Thursday evenings, and the annual convocation of the College on Friday evening will be held in the grand ballroom of the Waldorf Astoria Hotel.

The clinicians of greater New York are keenly interested to provide for the visiting surgeons a complete showing of the surgical activities of that great medical center and have arranged a program that will include all branches of surgery—general surgery, gynecology, obstetrics, orthopedics, urology, proctology, surgery of the eye, ear, nose, throat and mouth. The preliminary clinical program which appears in the following pages is to be further revised and amplified during the weeks preceding the Congress in order to present a more complete outline of the clinical work that will be demonstrated.

Clinics are scheduled for Monday afternoon beginning at 2 o'clock, and for the mornings and afternoons of each of the four following days. We have the confident assurance of the Committee on Arrangements that in point of scientific interest this Congress will surpass all previous efforts.

Wednesday has been designated as Brooklyn Long Island Day, and for that day special emphasis in the program is to be given to clinics in the hospitals of Brooklyn and the Long Island suburbs. A special program of clinics and demonstrations that includes many interesting features has been prepared by the Committee and is published in the following pages.

The Committee has provided for a series of fracture clinics in several of the larger institutions at which the methods employed and the results obtained in the treatment of fractures will be adequately demonstrated. An important feature of the clinical program is to be found in the series of demonstrations of methods employed in the treatment of cancer by surgery, radium and X-ray, also demonstrations of methods employed in the rehabilitation of persons injured in industrial accidents including surgical treatment and physical therapy.

The real program of the Congress will be issued daily in the form of bulletins that present a complete detailed schedule of the clinics to be given at each of the hospitals. These bulletins will be posted at headquarters each afternoon for the following day, and printed bulletins containing the same schedules will be distributed each morning.

Through the courtesy of officers of the sections on otolaryngology and ophthalmology of the New York Academy of Medicine, in co-operation with chairmen of sub-committees of the New York Committee on Arrangements, practitioners in these specialties attending the Clinical Congress are invited to attend special meetings of those two sections at the Academy on Tuesday and Wednesday evenings for which sessions special programs have been prepared as presented in the following pages.

At a session in the ballroom on Wednesday afternoon there will be presented a symposium on graduate and undergraduate teaching of surgery. A number of eminent teachers and clinicians of the United States and Canada have been asked to

contribute to this symposium. Among those who will present papers are Elliott C. Cutler, M.D., Cleveland; Irving S. Cutler, M.D., Chicago; George J. Heuer, M.D., Cincinnati; George P. Muller, M.D., Philadelphia; Fred C. Zappfe, M.D., Chicago.

The exhibition of surgical films has proved an attractive feature at Congresses during recent years so that for this year's session an extensive program is being prepared that will include a large number of the newer surgical films, both sound and silent, including some in colors. There will be a daily exhibition at headquarters which will include films produced under the supervision of the Board on Medical Motion Picture Films of the American College of Surgeons.

HEADQUARTERS

General headquarters for the Clinical Congress will be established at the new Waldorf Astoria Hotel, located on Park Avenue between 40th and 50th Streets. This magnificent new hotel with more than 2,000 guest rooms which will open October 1st affords unusual facilities for sessions of the Clinical Congress. The grand ballroom and other large rooms and foyers on the second floor of the hotel have been reserved for the exclusive use of the Congress for scientific meetings, conferences, film exhibitions, registration and ticket bureaus, bulletin boards, executive offices, scientific and technical exhibitions, etc. All the comforts and facilities of the old Waldorf Astoria which had been headquarters on the occasion of three previous Congresses will be found in the new hotel with many added attractions and conveniences.

Space has been reserved in the Astor Gallery, Jade Room, and other large rooms and foyers on the second floor of the hotel adjacent to the grand ballroom for the Technical Exhibition in which will be represented the leading manufacturers of surgical instruments, X-ray apparatus, operating lights, hospital apparatus of all kinds, pharmaceutical publishers of medical books, etc.

CANCER CONFERENCE AND CLINICS

The subject of cancer will be an important feature in the program for the Congress. Cancer clinics will be held at several of the hospitals and demonstration in research methods at several institutions where such research is being conducted. On Thursday morning there will be a session in the grand ballroom devoted to problems of administrative and scientific interest arising with the organization and conduct of cancer clinics in general hospitals. Among the subjects

to be discussed will be the general administration of such clinics, the reference of hospital cases to the cancer clinics, the role of the social worker, the character of the clinic conferences, nomenclature, custody of radium, and uniformity of records. In the afternoon following the annual meeting a symposium on cancer will be presented at which some of the educational and scientific phases of the cancer problem will be presented by American, Canadian and European workers in the cancer field. Certain phases of the cancer problem will be discussed in papers to be presented at the scientific session on Thursday evening by Sir Charles Gordon Watson of London, England, and Dr. Donald C. Balfour of the Mayo Clinic.

CONFERENCE ON INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

An all-day conference on traumatic surgery, under the auspices of the Board on Industrial Medicine and Traumatic Surgery of the College, has been arranged for Friday. Dr. Frederic A. Besley, chairman of the Board, will report on the work of that Board in recent years, outlining its present and future activities in respect to the nationwide survey of the medical and surgical facilities of our important industries. Hon. Alfred F. Smith, former governor of the state of New York, and Mr. Walter S. Gifford, president of the American Telephone and Telegraph Co., will discuss various phases of this important activity of the College. The tentative program is as follows:

TEMPLE F. V. M.D., Philadelphia: Deon mi Readjustment Following Industrial Injuries.
 CASS V. WATSON, M.D., New York: Industrial Medicine Applied to Medical Work in Industry.
 GEORGE R. FLETCHER, M.D., Detroit: Importance of the First Aid in Up Clinic.
 J. J. WITTE, M.D., New York: Some Methods for Reducing Industrial Accidents.
 WILLIAM R. MCCORMACK, M.D., Detroit: The Industrial Accident Case—A Field Trip to Industrial Surgery with Bert Recognized by His Days of Industrial Medical Festivals.
 WILLIAM R. CUBBINS, M.D., Chicago: Operative Treatment of Unilateral Fractures of the Femoral Condyles.
 COLONEL WILLIAM I. KILLER, Washington: The Prevention of Shock and Trauma During the Preparation of Surgical Cases by Fixed Tents and Splints.
 LIEUT. COL. ALFRED WILLCUTT, Washington: Local Anesthesia as a Factor in Industrial Medicine.
 WILLIAM L. ESTES, Jr., M.D., Baltimore: Pathology of the Industrial Accidents.
 DONALD GUTHRIE, M.D., St. Paul: Ethical Aspects of the Industrial Medicine.
 HERBERT W. MEYERDINE, M.D., Rochester, Minnesota: Spinal Injuries.
 HENRY E. FISKE, M.D., Chicago: Traumatic Surgery of the Spine.

HOSPITAL STANDARDIZATION CONFERENCE

An interesting program of papers round table conferences and practical demonstrations dealing with problems related to the hospital standardization program of the College has been prepared for the fourteenth annual hospital conference which opens at 9:30 on Monday morning in the grand ballroom of the Waldorf Astoria. The program for the annual conference has been planned to interest surgeons hospital trustees executives and nurses. The College extends an invitation to attend the conference to all persons interested in the hospital field.

Monday—9:30 A.M.—12:00 P.M.

- Chairman's address: The Obligation of the Hospital to the
 Interne Staff C. JEFF MILLER M.D. New Orleans
 Social Ideals in Hospital Service ALLEN B. KANAVAL
 M.D. Chicago
 Present Program of the American College of Surgeons
 FRANKLIN H. MARTIN M.D. Chicago
 Analysis of Findings from the 1931 Hospital Standardiza-
 tion Survey (illustrated) MALCOLM T. MACLACHERN
 M.D. Chicago
 Program of the American College of Surgeons for the Care
 of the Ill and Injured in Industry FREDERIC A.
 BESLEY M.D. Waukegan Ill.
 Organizing a Service for the Diagnosis and Treatment of
 Cancer in an Approved Hospital (illustrated) BOW-
 MAN C. CROWELL M.D. Chicago
 Responsibility of the Fellows of the College in Promoting
 the Hospital Standardization Program SOUTHWATE
 LYTON M.D. Norfolk Va.
 Unification of Aims in the Hospital REV. ALPHONSE M.
 SCHWITALLA S.J. Ph.D. St. Louis
 Our Challenge: How Shall We Meet It? PAUL H. FESLER
 Minneapolis
 Discussion GEORGE W. CRILE M.D. Cleveland

12:00 P.M.—5:00 P.M.

- Significance of the Seemingly Insignificant Matters in
 Hospital Management DONALD GUTHRIE M.D.
 Sayre Pa.
 Importance of More Adequate Sterilization Processes in
 Hospitals WALTER E. DANDY M.D. Baltimore
 Present Status of Hospital Costs and Charges—Report
 of a Nation-Wide Survey JOHN A. McNAMARA
 Chicago
 The Staff Conference Which Assures a Thorough Review
 of the Clinical Work and Maximum Benefit to the
 Medical Staff and Hospital (illustrated) ALTON W.
 OCHSNER M.D. New Orleans
 Important Factors in Assuring Efficient Nursing Care of
 the Patient JUNET F. KORNIGOLD R.N. New Orleans

Tuesday—9:30 A.M.—1:00 P.M.

- The Present Economic Depression in Hospitals—Increasing
 the Utilization of Hospital Facilities—Maintaining the
 Balance Between Economy and Efficiency C. J. CUMMINGS
 Tacoma Wash.
 What Shall We Do about Automobile Accidents?—Report
 of a Nation-Wide Survey MATTHEW O. FOLEY
 Chicago
 Factors to be Considered in the Cost of Medical Care
 from the Standpoint of the Hospital WILLIAM H.
 WALSH M.D. Chicago

- A Plan for the Systematic Instruction and Supervision of
 Internes and Resident Staff H. L. FOSS M.D.
 Danville Pa.
 Administrative and Medical Problems Associated with the
 Open Hospital FRANK J. WALTER Denver

2:00 P.M.—5:00 P.M.

- Hospital Social Work—A Particularly American Product
 RICHARD C. CABOT M.D. Cambridge Mass.
 A Plan for Efficient Follow-Up of Discharged Patients
 GEORGE GRAY WARD M.D. New York
 Social Service and Cancer Control GEORGE H. BIGELOW
 M.D. Boston
 General Discussion BURTON J. LEE M.D. New York

7:30 P.M.—10:00 P.M.

- Our Responsibility as Trustees F. L. BRAMAN Torrington
 Conn.
 Promoting a Better Understanding between the Super-
 intendent, Trustees and Medical Staff CHARLES F.
 NEEGAARD Brooklyn
 By What Criteria Can the Trustees or Governing Body
 Judge the Efficiency of Their Institution? S. S.
 GOLDWATER M.D. New York
 The Application of Business Principles in Hospital Ad-
 ministration HOWARD CULLMAN New York
 What Do Hospital Trustees Expect from Their Super-
 intendent? J. ALLEN JACKSON M.D. Danville Penn.

Wednesday—9:30 A.M.—12:00 P.M.

- How Can Scientific Clinical Records Be Assured (illus-
 trated) JAMES T. NIX M.D. New Orleans
 A Check System for Current Case Record DOROTHY
 GILMAN Seattle Wash.
 A Plan for Making Group Studies of Diseases (illustrated)
 PAUL W. WILLITS M.D. and DOROTHEA TROTTER
 Grand Rapids Mich.
 A Plan for Measuring Surgical Results in the Community
 Hospital CARL E. BLACK M.D. Jackson Ill.
 A Complete System of Departmental Daily Reports Es-
 sential in Efficient Hospital Administration SIDNEY
 G. DAVIDSON Grand Rapids Mich.
 General discussion T. R. PONTON M.D. Augusta Ga.

12:00 P.M.—5:00 P.M.

- Round Table Conference—Medical and Nursing Problems
 Conducted by R. C. BUEHL M.D. Madison Wis.
 Round Table Conference—Administrative and Economic
 Problems Conducted by ROBERT JOLLY Houston
 Texas

Brooklyn—Thursday—9:30 A.M.—12:00 P.M.

- Demonstration and round table conferences conducted by
 MALCOLM T. MACLACHERN M.D. Chicago and
 ROBERT JOLLY Houston Texas assisted by super-
 intendents and heads of departments of hospitals.
 Procedure in admitting and discharging patients
 organization and management of the case record de-
 partment nursing administration and service operat-
 ing room management and procedure organization
 and management of the interne service

12:00 P.M.—5:00 P.M.

- Demonstration and round table conference conducted by
 ROBERT JOLLY Houston Texas and MALCOLM T.
 MACLACHERN M.D. Chicago assisted by super-
 intendents and heads of departments of hospital
 Organization and management of the dietary de-
 partment and food service business methods in hos-
 pitals management of the obstetrical department
 handling of hospital visitors public relations

PROGRAMS FOR EVENING MEETINGS

WALDORF ASTORIA GRAND BALLROOM

Presidential Meeting—Monday 8 15 P M

Addresses of Welcome CHARLES GORDON HEYD M D Chairman New York Committee on Arrangements
and JOHN E JENNINGS M D Chairman Brooklyn Committee on Arrangements

Introduction of Foreign Guests

Address of Retiring President Medical Men and Their Lay Critics C JEFF MILLER M D New Orleans

Inaugural Address Fundamentalism and Social Progress in Medicine ALLEN B KANAVAL M D Chicago

The John B Murphy Oration in Surgery Murphy and Some Principles of Urinary Surgery ARTHUR
H BURGESS M B I R C S Manchester England

Tuesday 8 15 P M

The Present Status of Cardiac Surgery ELLIOTT C CUTLER M D Cleveland

The Operative Approach to the Heart and Pericardium ARTHUR M SHIPLEY M D Baltimore

Technique and End Results in Denervation of the Adrenal Glands GEORGE W CRILE M D Cleveland

Wednesday 8 15 P M

The Newer Concept of Chronic Arthritis RALPH PEMBERTON M D Philadelphia

A New Method of Operating for the Repair of Ruptured Cruciate Ligaments of the Knee Joint WILLIAM
R CUBBINS M D Chicago

Fracture Oration Some Old Truths about Fractures WILLIAM DARRACH M D New York

Thursday 8 15 P M

Some Experiences in the Treatment of Carcinoma of the Rectum with Radium SIR CHARLES GORDON
WATSON A B E C M G F R C S London England

Curability of Cancer of the Stomach DONALD C BALFOUR M D Rochester Minn

Pentoneal Adhesions Their Prevention by the Use of Digestive Ferments ALTON OCHSNER M D and
EARL GARSIDE M D New Orleans

Comocotion—Friday 8 15 P M

Conferring of Honorary Fellowships

Presentation of Candidates for Fellowship Class of 1931

Presidential Address The Program of the College and the Initiates Responsibility ALLEN B KANAVAL
M D Chicago

Fellowship Address

SURGERY OF THE EYE EAR NOSE AND THROAT

NEW YORK ACADEMY OF MEDICINE

Tuesday 8 15 P M

An Outline of the Activities of the Otolological Research Laboratory of the Johns Hopkins University during
the Last Five Years S J CROWE M D Baltimore

Some Intimate Studies of Nasal Function Their Bearing upon Diagnosis and Treatment ARTHUR W
KLOETZ M D St Louis

Wednesday 8 15 P M

Symposium on Injuries to the Eye and Orbit

Clinical Aspects EDWARD B HECKEL M D Pittsburgh GEORGE H CROSS M D Chester Pa
E S SHERMAN M D Newark and H S MILES M D Bridgeport Conn

Pathological Aspects BERNARD SAMUELS M D New York

Compensation in Eye Injury Cases A ZIMMER Director of Workmen's Compensation New York

Prevention of Injury to the Eye LOUIS H CARRIS Managing Director of the National Society for the
Prevention of Blindness New York

PRELIMINARY CLINICAL PROGRAM

GENERAL SURGERY GYNECOLOGY OBSTETRICS ORTHOPEDICS UROLOGY,
PROCTOLOGY SURGICAL PATHOLOGY ETC

CLINICS IN NEW YORK HOSPITALS

WOMAN'S HOSPITAL

Mo day

B H GOFF and R HURD—Gynecological patients
GRET STORER—Pathological demonstration at an
L FREDRIK J MATTHEWS—3 Orthopedic clinic
HARRIETT McINTOSH—4 X-ray diagnosis and death py
gynecology and obstetrics

T day

HERMAN GRAD and F A BULLARD—9 Gynecological

H G BUGBEE and staff—9 Urological
HARRIETT McINTOSH—2 X-ray diagnosis and death py
gynecology and obstetrics

GEORGE GRAY WARREN and L K FARRAR and W T KENNEDY—Gynecological patients

GRET STORER—Pathological demonstration at an
W H CLARKE—3 Catastrophes of gynecological

E C LYON and assistants—2 Perinatal clinic
H E PARDEE—3 Cases of pregnancy complicated by

heated cases

GEORGE GRAY WARREN and L K FARRAR—10 Ehemorrhage from the uterus that has been

L C LEE and assistants—Dermatological patients

HARRIETT McINTOSH—X-ray diagnosis and death py
in gynecology and obstetrics

Th day

R M RAWLINS and H H ALDRIDGE—9 Gynecological operations

H C BOBBER and assistants—4 Urological
HARRIETT McINTOSH—X-ray diagnosis and death py in

gynecology and obstetrics

B H CLARKE and R H HURD—Gynecological patients

GRET STORER—Pathological demonstration at an
E C LYON and assistants—3 Perinatal clinic

W L CARR, H R MINKS and J F LONDON—3 Infectious diseases

Friday

HERMAN GRAD and E A BULLARD—9 Gynecological operations

E C LYON and assistants—9 Perinatal clinic special
clinic for bacterial cases and infectious diseases

J N NATHANSON—Lectures

HARRIETT McINTOSH—X-ray diagnosis and death py
GEORGE GRAY WARREN and L K FARRAR and W T KENNEDY—Gynecological patients

W H CLARKE—2 Gynecological patients

GRET STORER—Pathological demonstration at an
E C LYON and assistants—3 Perinatal clinic

W L CARR, H R MINKS and J F LONDON—3 Infectious diseases

Monday—Daily demonstration of standard reduced technique
by the nursing staff of the department of obstetrics and
gynecology in patients of the hospital on Tuesday

MEMORIAL HOSPITAL

Mo day

H E MANN and M E ILLIS—2 Practical demonstration of a patient's biopsy of tumor

B S BARRINGER—230 Implantation of red matter in the bladder

B S BARRINGER, A L DEAN JR and R S FRYUSON—3 Endometrial carcinoma of the bladder

dermatitis of the prostate and treatment of the testis with lobectomy of case

T day

W P HEALY—9 Radium application for carcinoma of the uterus

W P HEALY and F R SMITH—93 Endometrial carcinoma of the uterus

EDITH H QUINBY—30 Method of determining the amount of radiation delivered to specified tumor

J F ADAIR and D PACK—Necrotic melanoma

R F HERNDEN—330 Roentgen ray treatment of the cells of the bone

F W STEWART—4 Exhibition of specimens of neoplasms

W day

DOLGAS QUICK, H E MARTIN and Ds WATSON—9 Carcinoma of the pharynx and larynx with application of operation of the end result

JAMES I RUGG—230 The treatment of lymphoma carcinoma of the lymphatic system with the exhibition of

Th day

B J LEE and F E ADAIR—9 Interstitial nephritis and application of radium for carcinoma of the testis

DR HOFFMAN—9 Pathological demonstration of the histology of the testis

B J LEE and F E ADAIR—Endometrial carcinoma of the bladder

G F BINKLEY—2 Radiation therapy for carcinoma of the rectum implantation of gold needles

W B COLEY and B I COLEY—3 Summary of methods of diagnosis and treatment of tumor of the prostate

Friday

F W STEWART—430 Pathology of the tumor

Exhibition of the treatment of carcinoma of the prostate with radium needles

Exhibition of the treatment of carcinoma of the prostate with radium needles

NEW YORK HOSPITAL

T day

JAMES MOPLEY HITZ or on duty staff—9 General surgery

O S LOWSLEY—2 Urology

W day

FUGENE H POOL and staff—9 General surgery

O S LOWSLEY—2 Clinical demonstration

Th day

JAMES MORLEY HITZ or on duty staff—9 General surgery

Friday

LUKE H P or on duty staff—9 General surgery

NEW YORK POST GRADUATE HOSPITAL

Monday

FRED H ALBEE—2 Orthopedic surgery
 GEORGE ANOPOL—4 30 Orthopedic clinic

Tuesday

J EASTMAN SHEEHAN—9 Treatment of keloidal scars eyelid ectropions facial burns cancer disfigurements

F W IETSON—9 Pediatric surgery

JOSEPH F MCCARTHY CLARENCE C BANDLER STANLEY K WOODRUFF JOSEPH A HYAMS J SYDNEY RITTER SAMUEL E KRAMER and C TRAVERS STEPIA—9 Demonstration of the new radio arc method of prostate and poststatic bar excision newer technical methods in the diagnosis and therapy of seminal vesicular conditions

MORTIMER N HYAMS—10 Demonstration of conization of the cervix

WALTER F DANNREUTHER— Gynecological operations

THOMAS RUSSELL—2 Spinal anesthesia

JOHN F ERDMANN—2 30 General surgical operations

CHARLES OGILVY—4 30 Orthopedic surgery

Wednesday

F P DE CAUX MRS C L P C P London England
 DR WIDENBOEN Freiburg Germany T DRYSDALE BUCHANAN and CHARLES GORDON HEYD—9 Dry clinic The barbiturates and basal narcotics compression to the lung from various surgical positions the spinal curar and ether anesthesia in the lithotomy position demonstration of the new Karl Connell apparatus investigations to minimize the explosive risk of ethylene

E W PETERSON—9 Pediatric surgery dry clinic

W W LASIER—1 Traumatic surgery

CHARLES GORDON HEYD—2 Operations Hei notomy choleystectomy thyroidectomy appendectomy

Staff—4 Symposium Liver and gall bladder WARD J

MCNEAL Liver changes in abdominal disease

JOHN A KILLIAN Biochemistry of liver and gall bladder disease CHARLES GORDON HEYD Jaundice

LOUIS R DAVIDSON Postoperative therapy

B W MOFFATT—4 30 Orthopedic surgery

Thursday

FRED H ALBEE—9 Orthopedic surgery

Staff—9 Dry clinic Diseases of the breast WARD J MCNEAL Fibrocystic mastitis HERBERT WILLY MEYER Malignancies of the breast CHARLES GORDON HEYD Surgery of the breast WILLIAM H MEYER X-ray therapy B A GOODMAN Glandular the apy in diseases of the breast EDWARD DENVEEN Postoperative and postoperative therapy

J W HINTON—9 Gynecological clinic

JOSEPH F MCCARTHY CLARENCE C BANDLER STANLEY K WOODRUFF JOSEPH A HYAMS J SYDNEY RITTER SAMUEL E KRAMER and C TRAVERS STEPIA—9 Demonstration on histopathology of prostate and vesicles exhibition of corrosion specimen mountings of the latter exhibition of methods of intravenous and retrograde urographic diagnosis

JOHN J MOORHEAD—2 Traumatic surgery

GEORGE ANOPOL—4 30 Orthopedic surgery

Friday

J EASTMAN SHEEHAN—9 Nasal disfigurements congenital or acquired elements all present nasal disfigurements involving loss of elements

THOMAS H CHERRY—9 Gynecological operations

Staff—9 Symposium Diseases of the thyroid RALPH R MOULTON Classification of goiter JAMES J FLEMING Iodine in goiter ILLIP A MACGUIRE Pre operative and postoperative therapy CHARLES GORDON HEYD Hyperthyroidism WALDEN F MUNS The heart in hyperthyroidism FRYNOLD CHURCH and DR MEERER Thyroiditis and Riedel's struma

E W IETSON—9 Pediatric surgery

WALTER F DANNREUTHER—10 Gynecological

HENRY H RITTER—11 Traumatic surgery

WALTER F DANNREUTHER— Gynecological operations

E C BRENNER—2 Surgical clinic late in the day

J F FRYMAN—2 30 General surgery

CHARLES OGILVY—4 30 Orthopedic surgery

FIFTH AVENUE HOSPITAL

Monday

BENJAMIN S BARRINGER and staff—2 Urological operations and demonstration of cases

Tuesday

FREDERIC W BANCROFT—9 Duodenal ulcer operation

CHARLES F TENNEY—10 Medical treatment of duodenal ulcer

FREDERIC W BANCROFT—10 Surgical treatment of duodenal ulcer

LEWIS G COLE—10 Radiological diagnosis of duodenal ulcer

FRANCES SHIELDS—10 Prenatal clinic

LEON S LOIZEAUX and staff— Demonstration of delivery room technique

Wednesday

DONALD GORDON—9 Fracture clinic treatment of fractures in a general hospital

B B PALMER and M W CART—2 Dental prophylaxis treatment of fractured jaws

Thursday

KINGSLEY ROBERTS—9 Abdominal operations Lactero logical studies of normal and infected peritoneal cavity

FRANCES SHIELDS—10 Gynecological dry clinic sterility

WILLIAM L SNEED—9 Orthopedic operations and demonstration of cases

LEON S LOIZEAUX and staff—2 Demonstration of delivery room technique

FREDERIC W BANCROFT—2 Dry clinic Cancer of the large bowel surgical treatment and follow up

ROBERT F POUND—2 Radiological diagnosis of cancer of the large bowel

Friday

FREDERIC W BANCROFT and M STANLEY BROWN—9 General surgical operations demonstration of postoperative thrombosis and embolism

MEDICAL CENTER

(Babies Neurological Pediatrics and Sloane Hospitals)

Monday

J BENTLEY SQUIER—2 Urological operations

Tuesday

BENJAMIN P WATSON—9 Gynecological clinic

Wednesday

HUGH ADCHINCLOSS—9 Surgery of the breast

Thursday

FORDyce B St JOHN—9 Surgery of the stomach and duodenum

Friday

WILLIAM DARRACH—9 Fracture clinic

NEW YORK POLYCLINIC HOSPITAL

Mo d y
 LOUIS J LARIN—3 Gynecol caloperat s
 F A F C Y E L M—3 Op ti e p c tology
 D A S R L A—3 Urolog caloperat n
 J P R F O T T C R A N T—3 C n r l s u g l p e t
 F C K E L L E R—4 3 D r y h n c S u g c l a a t o m y

T u s d a y
 M L O L M C A M P B E L L—9 O p r t e g y l o g y
 H A L D D M E E K E R—3 C n a l s u r g c l p e a t i o n s
 J E M E M L Y N C H—3 O p r t e p r o c t l o g y
 J S M C P H S O N—3 O b t e t c a l i n i c
 J O I J N U T T—4 3 O t h o p e d p r a t n s

W e d n e s d a y
 G E R G E B I E E—9 G y n e c l g a l p r a t
 A I S E L L E G S—G e n e a l u r a l o p r t i o n
 F A R D L F E L G G—3 C t e n t e l g
 J S V L I E—1 U l g c l o p e a t i o n s
 C I R L Y W A L L A C E a n d T O U P I C K N C O L A—4 3 O r t h
 p d c s

T h u r s d a y
 D W T E V—9 O p r a t e g y n l g y
 J I J M C G R I T—G e n l g c a l o p a t
 H C L A S E—o t e l s u r c l o p e t o n
 J R M H V A S—3 O b s t e t c s
 J I H M E T T—4 3 O d y n a m i c S u r g r y i t o g u

F r i d a y
 P W F I M C R E A D—9 O p a t v e g y n e c l y
 R I B W V—G e l s u r l p t o s
 W V H—o F t e l n
 H I T B R E E—3 O p a t v e u r l o g y

CITY HOSPITAL

M o n d a y
 I I K A N E—G n t n r y u y

T u e s d a y
 I W C R O S S—G e e l u g r y
 C I P L K E Y—R t l s e r y

W e d n e s d a y
 F M C O T E—G y n l o g y
 J B C L A R K—G n t r y s u r g r y
 J F I L D—O t h p d s u g r y

T h u r s d a y
 L W C O S M A N—G n e l u r y

F r i d a y
 F W P I N K H A S—G y n l g y
 J P L—P t h l o g l f e

LINCOLN HOSPITAL

T u e s d a y
 K I S H D C—d B S I R W I N—o G e e l l a l o p
 L T H I—9 C y l g l p t

W e d n e s d a y
 E D T R U E S E L L a n d C S R O G E R S—9 G e n r l s r g i
 p r a t
 P H W I L L M—9 C y l c l p a t i o
 G O T T E B—h l g n l

T h u r s d a y
 G A R C I T—d J F R I E D L A N—9 P l s t s u g r y

F r i d a y
 E J D A T—9 G y n o l c l o p e r a t n
 K I Y D I G H T—d s t a—10 C r a l s g r y

BELLEVUE HOSPITAL

Mo d y
 W I L L I M T D O R A N a n d a s o c i e—2 G a l l b l a d d d
 A R S T E V E N S a n d s t a f f—2 D e m o n s t r a t i o n f u r c a l

T u e s d a y
 R U S E L H P A T T E R S O N—9 G n r a l u g e r y
 A R T H U R M W R I G H T a n d t f f—9 G n r l g r y
 A P T I U R S M C Q U I L A N a n d E U F E N E B E C K—9 D i s e a s e
 f t h e t h r i d
 F C H O L D E N a n d s t a f f—9 G y n c o l o g c a l c l
 I R A K A P L A N a n d t f f—9 T a t m e n t f l n i b y
 r a d i a t i o
 A R S T E V E N S a d s t a f f—2 U l g c a l o p e r a t i o n s

W e d n e s d a y
 J O H N E S U T T O—9 G e a l s u g r y
 A R T H R M W R I T A d s t a f f—9 G e n e r a l s u r g r y
 I C H O L D E N a n d s t a f f—9 G n e c o l g l c l
 I R A F L A N a n d s t a f f—9 T r i n t o f m u l a n c s b y
 a t a n

K E N N E T H M L E W I S I I S I R I L E S T E R B R E I D E
 B A C H—2 I a c t c l i n i c
 A R S T E V E N S a n d s t a f f—2 U r o l c a l c l c

T h u r s d a y
 S t a f f c o s r g a l d i v i s i o n—9 G e r a l s r g d r y
 c l c
 J O H N H M O R R I S a n d J O H N V B O H R E R—9 C h e s t g e r y
 K E A F T M L E W I S—9 V a n s l
 C E O R G E D S T E V E R T A T H R M W R I G H T d t f f—
 11 3 G e r a l s u r g e r y d r y c l c

F r i d a y
 C E L G B U R D C K—9 G e c l u r g y
 G E O R G D S T E W A R T A R T H U R M W R I G H T a n d s t a f f—
 G n a l u r g y
 J A M E S W H I N T O N—2 G a t r n t e t l l
 A P S T E V E S a n d s t a f f—2 U o l c a l o p t o n s

ST LUKE'S HOSPITAL

T u e s d a y
 W A L T I M A R T I N—9 G e n a l s u r g e r y
 J N D O U L A S—9 G n l s u g e r y

W e d n e s d a y
 H H M L L E—9 G n a l u g e r y
 F K S M A T H E W S—9 G e n e l g r y

T h u r s d a y
 L O U I S J D O N O V A—9 G n e a l s u g e r y
 W I L L I A M F M A C F E E a n d E D W A R D D T R U E D E L L—9
 G e l u g r y

F r i d a y
 M O R I S K S M I T H—9 C e a l s g r y
 H E N R Y G B L O G E—9 G t u m a r y s g y
 M T E P C L E V E L A N D—2 O r t h o p d s u r g r y

LYNCH HOSPITAL

J M E A H A R R A R C F J E L L N O H A U S L A W I C M
 R O S E S H W H H A W K I N S K B S T E P H R
 S M I T J A G O R E A N N B S A K E T T J T B E R
 A N W C G O D D A R I a n d R L C P A I—9 d s O b
 t r a c t i n a n d l a b o r a t o r y f e m n t r t s

ST FRANCIS HOSPITAL

F G L D E T O N T H R U F C C J V M O D I d L A
 C M P H E L L—9 d l y G l l s r y a n d g y n c o l o g y

FLOWER HOSPITAL

Monday

CLAUDE BURRETT—2 Gouty problems
EARL LATON—2 Hernia clinic

Tuesday

HORACE AYERS—9 Tumors of the pelvis
HENRY SAFFORD—9 Elective cesarean
SPRAGUE CARLETON—2 Prostatic problems
WALTER HALFMAN—2 Kidney tumors
RAPHAEL LEWY—2 Industrial surgery

Wednesday

LOUI KAUFMAN—9 Hydronephritis
SAMUEL LUBASH—9 Kidney function tests
ANSON H. BINGHAM—2 Orthopedic surgery
MILTON WILSON—2 Compound fractures

Thursday

WILLIAM F. HONAN—2 Thoracic surgery

Friday

JOSEPH H. FOLBS—9 General surgery
WILLIAM A. FRASER—9 General surgery
WILLIAM P. ECKES—9 General surgery
GEORGE W. LUTTON—2 Traumatic infections of the hand
E. WELLES KELLOGG—9 Obscure infections of wound
Not—Demonstrations in new methods of anesthesia
by Donald Brace James Gales and George Van Gillewe

BETH ISRAEL HOSPITAL

Monday

HARRY E. ISAACS—2 General surgical operations
HERMAN SCHWARZ—2 Surgery in children

Tuesday

J. J. HERTZ—10 Gastric surgery
C. G. LANGROCK—11 Surgery in obstetrics
I. C. RUBIN—2 Gynecological operations
MARCU ROTHCHILD—2 Medical aspects of surgical cases

Wednesday

I. C. RUBIN—9 Gynecological clinic
A. HYMAN—1 Genito-urinary clinic
A. HYMAN—2 Genito-urinary surgery
LEO DAVITOFF—2 Neurological operations
E. D. FRIEDMAN—2 Neurological clinic

Thursday

M. ROBINSON—9 Gynecological clinic
LEO DAVITOFF—1 Neurological clinic
DEWITT STETTIN—2 General surgical operations
A. A. EPSTEIN—2 Medical aspects of surgical cases

Friday

DEWITT STETTIN—10 Surgical clinic
MEYER ROBINSON—2 Gynecological operations
ALFRED PLAUT—2 Pathological conference

JERSEY CITY HOSPITAL

(Jersey City N. J.)

Tuesday

CHARLES B. KELLEY—9 Gynecological clinic
S. B. SPRAGUE—2 Fracture clinic

Thursday

S. A. COSGROVE—10 Obstetrical clinic
W. G. DORAN—2 Fracture clinic

Friday

W. C. DORAN—9 Orthopedic clinic
Concussion dislocation of hip motion picture demonstration

NEW YORK ORTHOPEDIC HOSPITAL

Monday

ALAN DEF. SMITH and staff—2 Out patient clinic

Tuesday

RUSSELL A. HIBBS and staff—9 Ward round and post-operative clinic
RUSSELL A. HIBBS BENJAMIN P. FARRELL HALFORD HALLOCK and staff—2 Out patient clinic

Wednesday

RUSSELL A. HIBBS BENJAMIN P. FARRELL and staff—9 Orthopedic operations
ALAN DEF. SMITH and staff— Out patient clinic

Thursday

RUSSELL A. HIBBS and staff—9 End results of spine hip knee ankle and shoulder fusion for tuberculosis
BENJAMIN P. FARRELL HALFORD HALLOCK and staff—2 Out patient clinic

Friday

RUSSELL A. HIBBS BENJAMIN P. FARRELL ALAN DEF. SMITH HALFORD HALLOCK and JOSEPH C. RISSE—9 Spine fusion for tuberculosis and scoliosis hip and knee fusion for tuberculosis open reduction of congenital dislocation of hip
RUSSELL A. HIBBS BENJAMIN P. FARRELL ALAN DEF. SMITH and staff— Out patient clinic

Daily

Drs. HALBACH HOWORTH and SAUNDERS Exhibit of anatomical and pathological specimens
A. B. FERGUSON Photomicrographs and X-rays illustrating special X-ray technique

MOUNT SINAI HOSPITAL

Monday

ROBERT T. FRANK and staff—2 Plastic operations on the vagina
RICHARD LEWIS OHN—2 Blood studies in jaundice cases

Tuesday

A. A. BERG and staff—9 Gastrointestinal surgery
EOWIN BEER and staff—2 Genito-urinary surgery
HAROLD NEUBOR—2 Demonstration of the acid cases
W. HARRIS—2 Radiotherapy of surgical diseases

Wednesday

PHILIP W. NATHAN and staff—9 Orthopedic surgery
GEORGE BAER and PAUL KLEMPERER—3 Pathological demonstration

Thursday

RICHARD LEWIS OHN and staff—2 Thyroid surgery
ROBERT T. FRANK— Reconstruction of vagina demonstration of female sex hormones blood and urine tests
LEOPOLD JACHES and staff—2 Roentgenological aspects of surgical diseases

Friday

PHILIP W. NATHAN—9 Demonstration of orthopedic cases
HAROLD NEUBOR and staff— Chest surgery

DETENTION HOSPITAL

Tuesday

EDWARD C. BRENNER of HARRY V. SPAULDING—9 Gynecological operations

Thursday

EDWARD C. BRENNER of JOSEPH FULD—9 Gynecological operation

ROOSEVELT HOSPITAL

M d y
 J ME I PUSSE —2 G e r l g r y
 HE W CAVE— G r l s g r y
T d y
 A D STILL : N—9 G e l s g r y
 HO RD C TAYLOR—9 G y e c l g y
 CO D CT CUTLE — G l s g r y
W d d y
 KIR DWIGHT—9 G r l s g r y
 THOMA PEIGHTA —9 Gynecology
 G AN P PENNOY — G n r l s g r y
Tl d y
 W IAM C W TE—9 G a l s r y
 HO ARD C TAY O J —9 Gynec l g y
 H ARD A PATTE O — G e l g y
F d y
 EDWARD E KIL ANF—9 U ology

MISERICORDIA HOSPITAL

M d y
 F W SOVAK—2 Gynec l g y
T d y
 ANT ONY H HARRIGAN—9 G e l g r y
W d d y
 R E E BRENN N—9 G n l g r y
 J CO HECKMANN— G e l g y
Tl d y
 EDWARD F KIL NE—9 Gen to r y g r y
 ALEXANDE H SCHMITT— Ob t t

F d y
 F CTIS E BUTLE —9 O thop d
 GASTON A CA LU C — Gen l g r y

GOUVERNEUR HOSPITAL

M d y
 THOMAS H RUSS LL— G e r l s g r y
T e d y
 W L AM V HEAL V—9 F act re clum
 E YARD L K O — Gen e r l s g r y
W d d y
 W IAM A KE OC —9 G e l s g r y
 WILLIAM H W KNIP — Ob t t c s
 PHILIP M GRAUSMAN— G l g r y
Tl d y
 JOSE H G SOANSKY—9 G n l g y
 ALB RT E SELLENIN — G e l g r y

MONTEFIORF HOSPITAL

M d y
 JULIU GOTTESM Y MAURICE L NZ nd J M ZIEGLER—
 C l c
T d y
 P W N THAN—9 J O th p e c r g r y
W d d y
 H OLD NEUHOF— 3 Th r a r g r y
Th d y
 IRA C HEN— N r g al p t n

ST VINCENT'S HOSPITAL

T d y
 F WARD L KEYES d taff—9 U l gical cl c
 GEORGE R S UART—9 Gen l g r y
 F ANK N D V—9 G e l s r y
 W LLIAM G DOR N—9 Fr ct s
W d d y
 RAYMOND P SULLIVAN—9 S r g l l n
 WILLIAM M FORD W KRUGLER J McGRATH J HEN
 NESSY d A RAGGI—9 Gyn l g al l
 WILLI M G DORAN—2 Orth p d c c h c g taldis
 locat n f h p
Tl d y
 GEORGE DAVID S VART—9 G l u g c l p t
 ARTHUR M WRIGHT—9 G l gical ope t
 LD ARD A KING—9 G e l s g l ope at s
 LOUIS F SANMAN—2 Tra sf s
F d y
 WILLIAM M FORD W KRUGL J McGRATH J HEN
 NESSY d A RAGGI—9 Gyn logic l l
 CONSTANTINE J MacGUIRE—9 S r gic l dem t at
 of c

HARLEM HOSPITAL

M d y
 Staff— C n d n path l g y d s g r y
T e d y
 H C FALA a d st ff—9 G y e l g y
 SIDNEY A LE — R taldis a
W d d y
 JOHN F CONVO J WISHNE L WRIGHT a d J STEV
 BUCK—9 T mat s r gery
Tl d y
 H B LISBE o d C CASAS A—9 G e al g l h
 A M SALA a d B N BERG— S g c l p th l y
F d y
 H C FALA—9 D g t c g n l g y
 F KASSERBOM— Ob t tn l h

FORDHAM HOSPITAL

M d y
 A G FORMAN—2 G e l u g l p at
T d y
 L MARTON—2 G e l gical p tions
W d d y
 E R CONNIFFE— G al s u g l p e t
Tl d y
 S W BOO STE N—9 O th p d c p e at
 ALEXAND R N O L—2 G al g c l o p t
F d y
 J H T AIR—9 Ob t t l p t u s
 R EMMET WALSH—2 G e l gical p e r t u

MIDTOWN HOSPITAL

W d d y
 J S VEY RITTER—9 J U l cal clum
F d y
 LOUIS MA TON—9 G e l u r y
F d y
 MA N J SYNNOTT—4 P t l g l r g r y

RECONSTRUCTION HOSPITAL

Monday

- E A DOOLEY—2 Fractures of the forearm
 D GOLDBLATT—3 Fractures of the femur
 H M BERGAMINI—4 Fracture return clinic

Tuesday

- J J MOORHEAD—9 Traumatic surgery ward rounds
 H H RITTER and staff—2 Traumatic surgery operative
 H M BERGAMINI—2 Traumatic surgery operative
 W D LUDLUM JR—2 Traumatic surgery dry clinic

Wednesday

- W W LASHER—9 Injuries of the knee
 C A PETERSON—o 30 Head and spine injuries

Friday

- K G HANSSON and HAROLD M HERRING—9 Physical therapy

BROAD STREET HOSPITAL

Monday

- CHARLES GOODMAN—2 Vascular surgery
 GUSTAV TIECK—4 Sinus operations

Tuesday

- BENJAMIN TILTON—10 General surgery
 WILLIAM KELLOGG—2 Gastro intestinal surgery

Wednesday

- A J WALSCHOLD—o Gynecology
 MAURICE MELTZER— Genito urinary surgery

Thursday

- FRED DUNN—10 Oral surgery
 FRED H ALBEE—2 Orthopedic surgery

Friday

- POL CORILLOS—10 Thoracic surgery
 MAX BARUCH—2 General surgery
 T A SULLIVAN—4 General surgery

HOSPITAL FOR RUPTURED AND CRIPPLED

Tuesday

- CARL G BURDICK and staff—9 Hernia operations
 ARMITAGE WHITMAN and staff—2 Dry clinic Adduction treatment of fractures of the neck of femur

Wednesday

- FENWICK BEEBMAN and staff—9 Hernia operations
 WILLIAM B COLEY and BRADLEY L COLEY—2 Dry clinic Bone sarcomas

Thursday

- PERCY W ROBERTS WILLIAM L SNEED and staff—9 Orthopedic clinic
 JOHN F McWHORTER—2 Pathological demonstration of bone tumors

Friday

- WILLIAM L SNEED and staff—9 Orthopedic operations

KNICKERBOCKER HOSPITAL

Monday

- PHILIP D ALLEN—2 Blood transfusion Tindemann method

Tuesday

- W A FRASER—9 Gynecological clinic
 H J SHELLEY—2 General surgery

Wednesday

- PAUL C MORTON—9 General surgery

HOSPITAL FOR JOINT DISEASES

Tuesday

- P M GRAUBMAN—9 General surgery
 HARRY GOLDMAN—10 Proctological surgery
 H L JAFFE—11 30 Pathology
 A J BELLER—2 General surgery
 MILTON BODENHEIMER—2 General surgery

Wednesday

- H L FRAUENTHAL LEO MAYER and M M POMERANZ—9 Orthopedic clinic operations and demonstration of cases roentgenological demonstration of bone lesions

Thursday

- PAUL W ASCHNER—9 Urological surgery
 ARTHUR STEIN—10 Gynecological surgery
 M M POMERANZ—11 Pyelography

Friday

- H FINKELSTEIN—9 Orthopedic operations
 SAMUEL KLEINBERG—10 30 Demonstration of orthopedic patients

METROPOLITAN HOSPITAL

Monday

- J H FOSBES and staff—2 General surgery

Tuesday

- SPRAGUE CARLETON and staff—10 Genito-urinary surgery
 W F HOVAN and staff—2 Thoracic surgery

Wednesday

- H B SAFFORD and staff—o Gynecology
 R F WARD and staff—2 General surgery

Thursday

- W A FRASER and staff—2 General surgery

Friday

- A H BINGHAM and staff—10 Orthopedic surgery
 L C SALISBURY and staff—2 General surgery

LENOX HILL HOSPITAL

Tuesday

- FRANK R OASTLER and staff—9 Gynecological clinic
 FRANK R OASTLER and staff—2 Gynecological clinic

Wednesday

- DEWITT STETTIN and staff—9 General surgical clinic
 CARL EGGERS and staff—2 General surgical clinic

Thursday

- HERMAN FISCHER and staff—9 General surgical clinic
 OTTO H PICKHARDT and staff—2 General surgical clinic

Friday

- PERCY H WILLIAMS and staff—9 Gynecological clinic
 PERCY H WILLIAMS and staff—2 Gynecological clinic

STUYVESANT SQUARE HOSPITAL

Tuesday

- ALBERT S MORROW—9 Cancer clinic operative

Wednesday

- ROBERT H KENNEDY—9 Cancer clinic operations

Thursday

- ALBERT S MORROW—9 Follow up clinic on results in cancer patients

Friday

- ROBERT H KENNEDY—9 Follow up clinic on results in cancer patients

MORPISANIA HOSPITAL

Tie day

J LEVITS AMSTER-9 G n l u f al d m c
JULIUS J V LE TINE-2 3 U r l o g i a l s i g r y

Wed e day

I 7 A SPIES-9 F a c t u e s
J I C V I A M T E R- G n e a l u g i c a l d m c
S I W I T Z E R- 30 X y d m o t r a t i o n

T h s d a y

J I C I E-9 T h y r o i d n e r y
(E R M I L N I-2 3 G n e r l s u r g e r y

F d y

E I A SPIES-9 O p e r a t e s k i l l i g e r y

BRONY HOSPITAL

T e d y

A O W I L E N S K I-2 G e n e r a l s u r g e r y

W e d n e d a y

J B G E R-9 G n e l s u r g e r y
W I N E C O R-9 G e n e r a l s u r g e r y

F d

A I C O-9 G n e r l s u r g e r y
A O W I L N Y- G e n e r a l s u r g e r y

ST MARY'S HOSPITAL

T d

(F F E R-9 U d c d d t s t a n c h i l d e n

T h d y

I A D T U S D E L L-9 K i l l i n d c l e f t p a l a t e

F d y

I C A W I C-9 C o n g e n i t d e f o r m a t e

FRENCH HOSPITAL

T e d y

J R T U R U R L M A F A N M I B L A & H C F A L K
n d t a f f-9 G e n e r a l s u r g e r y

W e d n e d a y

I G C O L L I a n d I P T U R U R-9 S u r g i c a l d X r a y
l i n e

CANCER INSTITUTE

T d y

I I K A P L A N- C a n c e r l i n e

SPECIAL CLINICS FOR BROOKLYN-LONG ISLAND DAY-WEDNESDAY

NORWEGIAN LUTHERAN HOSPITAL

E F R S F S A L T V D L O S T O N E L S T A P
P O U B H R I J H B D A D G H V E R A D
J J M S T E R S O-9 G e n e r a l s u r g e r y c o l o c a l
a d o r t h o p e d i t i n d u i l y e
h b tF F E R R I S-2 T e t m n t i f t e t y p e n a n d i d
e d u t nD L I T U S O E- 30 H y p e t p h y l o n e s t n s n
n b o r nE S A L I O-3 P r i f a t e d p e t c u l c e r s
B H B R S-3 3 M a n m n t f e r t i l a t s n
l a b o

P P L T O U-4 S p a l a e s t h e s

LEBANON HOSPITAL

T y

HARRY ARA O A J R O N V n d E D W A R D S C H N A P E R-9
G y n e c l o y

W e d n e d a y

M I L T O N R B O O K M A N P H I L I P M G R A U S M A N L M I L L E R
K A H N a n d H E R Y R O T I-9 G e n e r a l s u r g e r y

T h d y

H A R Y A N O W A J R O N G Y a n d E D W A R D S C H N A P E R-9
G y n e c l o g y

F d y

M I L T O N R B O O K M A N P H I L I P M G R A U S M A N L M I L L E R
K A H N a n d H E R Y R O T I-9 G e n e r a l s u r g e r y

BEEKMAN STREET HOSPITAL

T d y

R O B E R T K E N N E D Y a n d H H E Y L-9 F r a c t u r e c l i n i c

W e d n e d a y

R A L P H C O L P-9 O p e r a t i o n e r q u a d r a n t

T h s d a y

W W A T T E R S a n d W S W I F T-9 O r t h o p e d c o n s u l t a t i o n s

T d y

S I M U N D M A G E a n d R O B E R T F I N D L A Y-9 F r a c t u r e r o u n d s

JEWISH MATEKNITY HOSPITAL

T e d a y

N R A T O F F a n d s t a f f-9 O b s t e t r i c a l c l i n i c
N R A T O F F a d s t a f f-2 O b s t e t r i c a l o p e r a t i o n s

W e d n e d a y

S J S C A D R O N n i s t a f f-10 O b s t e t r i c a l c l i n i c
S J S C A D R O N n d t a f f- O b s t e t r i c a l o p e r a t i o n s

T h s d a y

E G L A N C R O C K a n d s t a f f-10 O b s t e t r i c a l c l i n i c
E G L A N C R O C K a d s t a f f-2 O b s t e t r i c a l o p e r a t i o n s

CORRECTION HOSPITAL

T e d y

E D W A R D C B R E N N E R- G e n e r a l s u r g e r y

W e d n e d a y

C E Z A G R E E N B E R G-9 G e n e r a l u r i n a r y s u r g e r y

T h s d a y

E D W A R D C B R E N N E R a n d M O M A G I D-2 G y n e c o l o g i c a l
o p e r a t i o n

BUSHWICK HOSPITAL

G H R E I C H E R S a n d s t a f f P E S M I T J G K A S P E R a n d
t a f f I H W B E N D T-9 n d i G e n e r a l s u r g i c a l
p r a t i o nW F L I P O L D a n d s t a f f a n d H W D A N G E R-9 G y n e
c o l o g i c a l p r a t i o n

N I V A D E R-9 E m g e n c y b s t e t r

J C W E I T A S-1 G e n u r i n a r y o p e r a t i o n s

B F M A C O-1 T r a u m a t o f f r a c t u r e

W E L I P P O L D a n d S C H U S S E I M-2 S t a t a e s t h e s
l a b o r p lM W E I S S E R a n d F M I L K O C H- P a t h o l o g i c a l c o n
f e c

LONG ISLAND COLLEGE HOSPITAL

Department of Urology

- J S READ Resection of infected renal calyx with stone
 A HARRIS Nupercain anesthesia in urology
 F L SINGER End results in ureterosigmoidostomy
 G R HORTON The prostate and vesicles as factors in arthritis
 W B TATUM Stricture of the female urethra
 P C FLERI Idiopathic scrotal gangrene
 I K MORGAN Five years experience with vas resection
 I C FARROW Resection of urethral diverticulum

Department of Obstetrics and Gynecology

- A C BECK End results in eclampsia
 W A JEWETT Complications of fibroids
 GORDON GIBSON Prolapse of the uterus
 H B MATTHEWS Ectopic gestation in women over thirty five years of age
 S A WOLFE Sarcoma of the uterus
 C W PHILLAN Seminoma of the ovary
 B A HARRIS Complications of ovarian tumors
 T S WELTON Congenital atresia of the vulva
 M GLASS Intraligamentous pregnancy
 A S MACGREGOR Embryonal carcinoma of the ovary in a fifteen year old girl
 V P MAZZOLA Postabortal sepsis
 S KAMINSTER Aschheim Zondek and similar tests
 M V ARMSTRONG Management of occipitoposterior

Department of Surgery

- E GOETSCH Preparation of patients with hyperthyroidism for operation factors of safety with especial reference to the use of iodine
 R F BARBER Test for circulatory efficiency in trematics
 S P BARTLEY Complications and dislocations of the shoulder joint with end result
 A GOETSCH Results of combined treatment with X-ray and the administration of Lugol's solution in early hyperplasias of the thyroid
 R T HARLOWE The surgical treatment of bilateral empyema
 B M CASSEL Thyroductal anomalies pathology and surgical treatment
 E J BROWDER Diagnosis and treatment of brain abscess
 E L DUNN Suppurative mediastinitis presentation of a case
 D A MULVIHILL Malignancy of the thyroid gland report on a study of 27 cases
 E J GRACE A study in tissue culture 45 malignant and non malignant tumors

ST JOHN'S HOSPITAL

(Long Island City)

- WILLIAM J LAVELLE S KLEIN and staff—9 Gastroenterostomy for duodenal ulcer treatment of fracture of femur by open reduction
 JOHN McMAHON and staff—9 Abdominal section for deformed pelvis
 J PAUL McFUGH M WEINSTEIN and staff—11 Hysterectomy for fibroma of the uterus reamputation for thrombophlebitis obliterans
 GEORGE C BIONDI—11 Prostatectomy second stage operation
 DENNIS E McMAHON I L STEIN and staff—1 Cholecystectomy for gall bladder disease thoracotomy by cloed method for empyema
 HENRY P MCKEN—11 Unusual obstetrical case use of high forceps

MASSAU HOSPITAL

(Mineola)

Staff—9 General surgical operations

METHODIST EPISCOPAL HOSPITAL

- Staff—9 a.m. and 2 p.m. Operative and dry clinics
 C H GOODRICH and R F SEIDENSTICKER End results following gynecological operations
 H T LANGWORTHY Tumors of the kidney
 H K BELL Acute osteomyelitis
 D L MCKENNA Dislocation of cervical vertebra exhibition of case
 E J BROWDER Management of peripheral nerve injuries with end results and exhibition of cases
 CLAUDE C KELLY (Hartford) Plastic surgery lantern slide demonstration
 FRED KANLIN (Mayo Clinic) Dry clinic
 S G CLARK Ectopic pregnancy rupturing into the sigmoid
 J H BLISS Role of calcium metabolism in hyperthyroidism
 J A TIMM Inject on treatment of varicose veins

Symposium on Gall Bladder Disease

- O P SCHNOEMANN Anatomy of biliary tract
 E B SMITH Pathology of gall bladder and liver
 H GRAHAM Early operation for acute cholecystitis
 RUSSELL FOWLER Unusual gall bladder cases
 F B CROSS Pre and postoperative use of glucose exhibition of cases
 P A RENAUD Cholecystectomy without drainage

Symposium on Obstetrics

- O I HUMPHRIES Cesarean section in the treatment of bleeding during pregnancy
 R M BEACH Medial versus lateral episiotomy moving picture demonstration
 H B MATTHEWS Management of pregnancy in the presence of pulmonary tuberculosis
 H W MAYES Vaginal versus rectal examinations in relation to obstetrical morbidity

CUMBERLAND HOSPITAL

- H WILEY—9 15 Pen arterial sympathectomy moving picture demonstration
 JOHN GINLEY and staff—9 15 General surgical operations
 J T JENNINGS and MERRILL N FOOTE—9 30 General surgical clinic
 FUAD I SHATARA—10 30 Demonstration of the Russell Balance tract on apparatus for treatment of fractures of femur with exhibition of patients relief of the injection treatment for varicose veins as compared with operative treatment exhibition of patients general surgical operations
 MERRILL N FOOTE and staff—10 30 General surgical operation
 JOHN E JENNINGS—11 30 General surgical operations
 MERRILL N FOOTE and M J FEIN—1 30 Histopathology of gonor
 H WILEY and staff—11 30 General surgical operations
 JOHN GINLEY—2 Surgery for the cancer patient analysis and end results
 M J FEIN—2 Gross pathology as related to the surgeon specimens lantern slides
 JOHN E JENNINGS MERRILL N FOOTE CHESTER DAVIDSON and JOHN GINLEY—2 Demonstration of interesting cases
 ROBERT KINLOCK—2 30 Transplantation of the ureters with exhibition of patients
 FREDERICK ELLIOT—3 Radiography as related to general surgery diagnosis and prognosis discussed and illustrated by moving picture head neck chest and abdomen and fractures special reference to intestinal obstruction
 CHESTER DAVIDSON—4 Surgical treatment of unusual cases

ST MARY'S HOSPITAL

St ff—9 Operat ecl c gen lsu g y gyn logy
 u ology p ocl lgy nd rth p dcs
 St ff—9 d Dry cl s
 R B A PR OV Ur loge l cas
 W V PASCUAL G l l b d d es bd m n l w l l n
 fect
 W MOIR JR Imp t e f blo d ch m try
 s g y
 W E McCOLOM D bete n s gery
 A W M RTIN M RINO H ch pr u s d e ch n c
 l t i bt
 E AR P DLNN Thy d d a e
 D E W CH Tnd tue
 CHARLES H LOU R Y d C A NOLAN Imp o d
 m th d bl dm tch g
 J Rizzo d II MURPHY Injct t tme t f o
 P J DULLIGAN V ts g g locyt g
 g b l s fct
 E J CRONIN U us l empl t n c t pp n
 d ct
 E A KEES O n y t m phating p gn cy
 th t ea
 M MURPH Lnd lt b ech
 CIL S L UC N B dl r g as n ect
 J J COLL S L d t t obl m
 F W C D s s fth bo
 J P M Ch c y o t s f k
 J P Mu d E J G CR l t n h p o f t g c
 sa m d i m p i g
 E J G CE G d d c f b t d p gno
 pl m
 R F M AL B t oph w h g s f o m o
 log l fct
 WILIS MOIR E J Tr h m g al fct
 n l t togy lgy
 T M BRE N AN Act p n tt
 St ff f t cl

JEWISH HOSPITAL

WILL LINDER W LAM WO SOV SAM LINDER d
 t ff L r fthe lo p t n
 J HN LNDL A H I o LOUS BERG R d t ff
 G t c t f l d c c l t mach
 H W LOUR Thy d g ry
 A R CH L thotriptose py d ol g c l p rat
 B E W L O R E d r l s n b o e g r l t g d l b o v
 f t
 BENJ M N h v d Mo s KOVEN F dam tal
 l n t m n t f c t es
 BENJAM KR M D t t ma g m t o f t t l
 d t l c f c t t m p c t
 d m trat
 A OL B NER T m t f c a c m a f c v
 M G WASCIT R d l g c d m n t t n f m e t t a t c
 d s e f b m a l g n y f b o p d p t
 d t m l t p l g t l t m o p m p n
 t m g t t e t l t d e
 MAX L ER D m n t u n d h b t I m d
 p m t f p th lowy
 I S D E V et f b n b s e s
 M RO S Z IG A h h m Z o d k t t f p r g n cy
 M C RNE d H RASCH F P d i t n g c al d o b
 t t l p th l y
 W Z FR A I t h l CO p p a t
 A S W I R T f w b m f p n t age
 M L ERER P h l l n f n c
 S II POLAYES B l d t f u n

WICKOFF HEIGHTS HOSPITAL

JOHN G KAUSS JOHN HO NI PUSSEL S FOALER d
 C ARLES PF UC—9 C eals gical oper t o s
 J ARTHUR BU I ANAN—9 45 A su gical p rpu
 L O L R OWI — o Syphilis f th l ier
 A L E R COOK—5 D e c u l t s
 G ORG FORBES—3 A y d monst tuo on p eu
 moth a
 DAVID GINGOLD—45 Pyl n st s f t s
 CA L FISCHIE—R ptu ed ut ru t term f tu n
 abdom al ty c v a c t
 RUDOL H EIMAN—5 C esari n ect m g
 p c t e d m t t o
 WILL M B ROSEC s—3 F c t es f the sk l l
 p l y p t o n a d e c y
 CHA LES PFEL —45 The m commo dislocat ns
 W I L I A M F O ENIL RDT—1 P pl l de oma of kidney
 m t a s n b l d d n e y l t r
 L C BERNAUER—5 Imp t u g ob t e t l w r k
 l a t m l d d m o t a t
 L D X L R—3 R l c b n e l m p t
 J G KARAUS—45 I g n b d y kn j t m a g n t
 W I L I A M C O O K A L MUELL J R LDO PR H RRI
 m a d A R CR HOLZMAN—G e a l g i c l
 op t
 JOHN HORN—15 Subtot l ect n o f t m ch
 T U R O N D E N T E —3 P th logy f g l l b l a d d e d s
 CHRIS AN JANS N—45 L aluat f th n u s h e r
 fu t n t s
 A R T U R HOLZMAN—3 An m a l k e s f c y s t c a d h e p a t i c
 t
 RUSS L S FOALER—3 5 I n t r a c t a b l e a b d m l
 W I L I A M L A I N G —33 D b t m l l t s p p r t i e
 t m y l t o l h s t m t a t a s o l g i c a l c
 ROSAR MULE—3 45 G n t n n a r y c a s

BIOCKLYN HOSPITAL

W A SIE OOD E K TANN W H FIELD d J B
 GVEN JR—9 G n e l s gical p m t
 V L ZIMMERMAN E BISHO a d W S SMITH—9
 Gyn l g l d b t l o p a t u d d m
 t t n t s e
 W P RAT BUV a d W F McKENNA—9 C y s t s c p c
 l n c
 St ff—D m n t t f u l o c a l X y s
 W A S R O O D d JAMES DENTON—2 S g c al
 p th l l o n f c
 D E M K E N —3 O th p e d i c p e t u a d
 d e m t t n f s
 J E J V N G S—D y l t h d m t r a t o f e n s e
 N P R A T I B U N a d W F M c k E N N A —2 U l g i c a l
 op t n

CARSON C PECK MEMORIAL HOSPITAL

JOHN F RA AN—9 G l s gical op at
 CHARLES S COCHRANE a d STANLY D BANKS—9 G
 l s g l p t s
 M RILL N FOOT—9 G r a l g u l p e r t o
 W I M W H E A —9 E h u b t f p e c m a d e r
 l b t y s t f p e n a y
 CHARL E STN D—R d g r a p h i c t d y o f g t r o
 t t l b t r u c t n
 H C ALL R L WOOD a d O A GORDO J—
 O b t a l a l c f e n p a l a n a s t h
 t t n c h b t n f i c a
 HERBERT T W I L —2 G r l g l p t
 THEO ORE L VOSS R a d C A R L E O N C M P B E L—
 A t u d y f p t i t

ST PETER'S HOSPITAL

- MATTHEW C. GOLDEN Bronchoscopic diagnosis of diseases of the respiratory tract lantern slides
 T. A. MCGOLDRICK Clinical considerations in above cases
 CORNELIUS SCHMID Operability in thyroid disease
 HARRY MCTAGUE Arterial occlusion in cardiac arrhythmia with gangrene of an extremity carcinoma of the thyroid gland
 HAROLD DENMAN Syphilis of the lung
 NUNZIO RINI Experiences in spinal anaesthesia
 SAMUEL SCUDERI Pancreatic cyst
 LOUIS BERGER Clinical management of acute intestinal obstruction
 JOSEPH TODD Treatment of sterility in the female with end results
 WILFRED EGAN Uterine fibroids—salient points in diagnosis clinical course and ultimate results
 JOSEPH MCGOLDRICK Hysterectomy
 WILLIAM ENNIS An improved method of operative treatment in inguinal hernia
 FREDERIC PAPPARD Experience in management of abdominal surgical cases
 HENRY MORTON Abdominopelvic fascia in relation to suprapubic cystotomy
 THOMAS M. BRENNAN A study of case histories in obstructive jaundice with comment on diagnosis clinical course and management
 GORDON GIBSON Conservative treatment of pelvic inflammatory disease
 JOHN L. JENNINGS Thromboangitis obliterans
 JAMES SHAY Postoperative pulmonary complications
 LOUIS BREGGIO Report on a series of cases of acute empyema with conclusions
 HENRY FEINBLATT Types of hyperthyroidism
 LORNE M. RYAN Gall bladder disease
 FRANK RYAN Demonstration of pathological cases
 RICHARD FETT Demonstration of thoracic cases
 RICHARD A. RENDICH Gastrointestinal diagnosis

NORTH COUNTRY COMMUNITY HOSPITAL
(Glen Cove)

- A. M. BELL, W. I. TITUS, G. L. FAIR and W. J. DUNNE—9
 Obstetrical clinic
 R. DERBY, J. W. BULMER, M. W. JACKSON, G. D. DUREA, J. L. NEUBERT and A. F. KOWSON—9 30
 General surgical clinic
 E. C. JESSUP, N. C. STEVENS, R. E. LEASE, E. C. BRAY, NARD and F. C. EDMONDS—10 30
 Medical clinic
 L. D. LARIMORE—11 30
 Laboratory demonstration

GREENPOINT AND ST. CATHERINE'S HOSPITALS

- FRANK D. JENNINGS and FRANK TARSNEY Demonstration of pelvic hammock—a new device for rhythmic traction in the treatment of fractures
 JOHN W. SCANNELL Demonstration of method and technique of blood transfusion
 FRANK D. JENNINGS Consideration of inguinal hernia

QUEENSBORO SURGICAL SOCIETY

- Special meeting at 3 30 p. m. in the building of the Queens County Medical Society 112 Queens Boulevard
 EDWARD L. KEYES The principles of prostatic surgery
 HENRY W. SCHOEVEL Operative obstetrics with demonstration by motion pictures

HOUSE OF ST. GILES

- CHARLES D. NAPIER and JOSEPH B. L. EPISCOP—2
 Exhibition of orthopedic cases

ST. JOHN'S HOSPITAL

- GLEN R. MACLACHLAN—9 Report on breech deliveries
 CHARLES W. MUELLER—10 Management of placenta previa
 CAMERON DUNCAN—10 30 Cervical dystocia in elderly primipara
 ALFRED W. WHITE—11 Resume of two years obstetrical work
 ONSLow A. GORDON—11 30 Discussion of ward cases
 GEORGE R. MARSH—12 Clinical study of inguinal hernia with end results
 STANLEY B. THOMAS—2 Cancer of the rectosigmoid choice of operation
 ROBERT B. ANDERSON—2 30 Is nephrectomy indicated in the unilateral closed tuberculous kidney?
 JOHN E. JENNINGS—3 Surgery of the terminal ileum
 AUGUSTUS HARRIS—3 30 A general consideration of fibrous vesical neck obstruction
 G. FRANK SAMMIS—4 Consideration of full thickness (tub) graft and fascial transplant
 WARREN L. DUFFIELD—4 30 Clinical review of cases of pericolic membranes

CONY ISLAND HOSPITAL

- J. EARL MILES Tubal insufflation with abdomen open
 GEORGE WEBB Skeletal traction
 D. A. MCATFER Traumatic shock
 PHILIP GOLDSTEIN Residual peritonitis
 PAUL WESENBURG Difficult labor
 ARTHUR C. GRAVES Conservative methods in obstetrics
 WILLIAM B. TATUM Management of ruptured kidney
 RAY M. BOWLES Suprapubic vs. perineal proctectomy
 A. J. MENDELSON X-ray demonstration of bone tumors

LUTHERAN HOSPITAL

- A. VON P. FARDELMANN—9 Hypertrophic pyloric stenosis in infants—history diagnosis treatment and results presentation of cases
 WALTER LYNN—10 30 Operative gall bladder mortality
 DELFINO MASCOLO—11 Subphrenic abscess cases
 PAUL RAJA—11 15 Fibromata of intestines pathological and lantern slide demonstration
 VINCENT BARBER—11 30 Leptoma of intestine causing intussusception
 EMIL F. KOCH—2 Pathological demonstration
 H. C. EICHACKER—2 Discussion of eclampsia
 HEINRICH WEHRHEIN and ALBERT L. VOLTZ—2 30 Interesting types of urinary tract pathology
 V. GIANTIERI—2 30 Leucotheca
 ALBERT L. VOLTZ—2 30 X-ray demonstration Types of mastoids roentgenologically considered chest differential diagnosis X-ray diagnosis X-ray diagnosis of bladder ulcer by use of hydrogen peroxide (Dr. L. Dänken method Berlin) unusual cases of general interest
 H. C. EICHACKER—2 45 Cesarean section review of cases
 CAMERON DUNCAN—3 Uterine bleeding lantern slide demonstration

FLUSHING HOSPITAL

(Flushing)

- J. S. THOMAS—9 30 General surgical operations
 A. S. LOWSLEY and W. K. ROGERS—9 30 General surgical clinic
 G. J. J. LAWRENCE and J. L. MORRISSEY—9 30 Gynecological operations

KINGSTON AVENUE HOSPITAL

- Staff Dry climes and exhibition of cases
 RALPH F. HARLOW Treatment of empyema

BROOKLYN HOSPITAL

Tuesday

W A SHERWOOD—9 General surgical operations
V L ZIMMERMAN and staff—9 Obstetrical and gynecological clinic and conference

Thursday

W A SHERWOOD—9 General surgical operations
JOHN E JENNINGS—9 General surgical operations
N P RATHBUN—9 Cystoscopic clinic
D E MCKENNA—10 30 Orthopedic operations

Friday

W A SHERWOOD—9 General surgical operations
N P RATHBUN—9 Urological operations
V L ZIMMERMAN—9 Gynecological operations
JAMES DENTON—11 Clinical surgical pathological conference

ST PETER'S HOSPITAL

Tuesday

GORDON GIBSON—9 Gynecology
J TODD—9 Gynecology
H FETT—9 Orthopedics
H MORTON—2 Genito urinary operations

Thursday

J E JENNINGS—9 General surgery
T M BRENNAN—9 General surgery
F PAFARD—9 General surgery
W ENNIS—9 Traumatic surgery
H MORTON—2 Genito urinary operations

Friday

GORDON GIBSON—9 Gynecology
J TODD—9 Gynecology
H FETT—9 Orthopedics
H MORTON—2 Genito urinary operations

BUSHWICK HOSPITAL

Tuesday

HARRY W DANGLE—9 Gynecological clinic
RICHARD C WEITHAS— Genito urinary clinic

Thursday

NATHAN H ADLER—9 Emergency obstetrics and wards
W E LIPFOLD and S S SCHUSHEIM—9 Gynecological clinic
GERARD KASPER—2 General surgery

Friday

H WRIGHT BENOIT—9 General surgery

ST JOHN'S HOSPITAL

Tuesday

WARREN L DUFFIELD—9 General surgery
STANLEY B THOMAS—9 General surgery
ROBERT B ANDERSON—1 Genito urinary operations
ONSLOW A GORDON JR—2 Obstetrics

Thursday

ROBERT B ANDERSON—9 Genito urinary operations
STANLEY B THOMAS—9 General surgery
CAMERON DUNCAN—2 Obstetrics

Friday

G FRANK SUMMIS—9 General surgery
WARREN L DUFFIELD—9 General surgery
HAROLD K BELL—9 General surgery

ST MARY'S HOSPITAL

Tuesday

WILLIAM V PASCUAL—9 General surgery
P J DULLIGAN—9 General surgery
E A KEYES—9 Gynecology
R B ANDERSON—9 Urology
Staff—2 Fracture clinic

Thursday

WILLIAM V PASCUAL—9 General surgery
P J DULLIGAN—9 General surgery
E A KEYES—9 Gynecology
R B ANDERSON—9 Urology
Staff—2 General surgery dry clinic transfusion

Friday

J P MURPHY—9 General surgery
T M BRENNAN—9 General surgery
J F GLANN—9 Gynecology
T A SHIELDS—9 Proctology

CONEY ISLAND HOSPITAL

Tuesday

J EARL MILES—9 30 Gynecology
JOHN H CRAWFORD—2 Pre and postoperative care of the cardiac patient
RAY M BOWLES— Preparation of the prostate case
J EARL MILES—2 Miles modification of the Rubin test
ARTHUR C GRAVES—2 Postpartum hemorrhage

Thursday

GEORGE WEBB and J EARL MILES—9 General surgery
P I NASHI—2 Pre- and postoperative treatment of diabetic patients
GEORGE WEBB—2 Traumatic surgery
GEORGE G FISHER—2 Biliary surgery common duct stones

CALEDONIAN HOSPITAL

Tuesday

CALVIN BARBER—9 General surgical operations
JOSEPH TENOPYR—9 General surgery dry clinic

Thursday

CALVIN BARBER—9 General surgery
JOSEPH TENOPYR—9 General surgery dry clinic

Friday

WILLIAM A JEWETT—9 Obstetrics
JOSEPH TENOPYR—9 Fracture clinic
CHARLES S COCHRANE— Genito urinary operations

CARSON C PECK MEMORIAL HOSPITAL

Tuesday

J F RANKEN—9 General surgical operations
O A GORDON JR—2 Obstetrics

Thursday

T L VOSSELER—9 General surgical operations

Friday

H T WILLE—9 General surgical operations

HOUSE OF ST GILES THE CRIPPLE

Tuesday

JOSEPH B L EPISCOPO and CHARLES DWIGHT NAPIER—10 Orthopedic clinic

Thursday

JOSEPH B L EPISCOPO and CHARLES DWIGHT NAPIER—10 Orthopedic clinic

ST JOHN'S HOSPITAL

(L g I l nd C ty)

T d y

D F McM I L STEIN l t ff—9 Gen l u g

J J McM I L DON d t ff— Gynecologic l op rat o

Tl d y

W J L ELLE S M CO EN d taff—9 Ge e l surg

(C B ONDR d t ff— U o l g l p t s

Frd y

D I M M I L ST IN d t ff—9 Ge l su gi
l p e t

ST CATHARINES HOSPITAL

T d y

JOI V M SCV NELL d F K D JENNINGS—9 Gen r l
ge y

Th d y

C RLES A GO ON—9 Gyn l ey

Fid y

M V L B AIN—9 Rect l g y

DA I A McATL R—9 Ge e l g y

MARY IMMACULATE HOSPITAL

(J mac)

T d y

I M D —9 G l g ry

Th day

l L H—9 Gen al g y

l B A ERS V—9 G l n ry s g y

F M I K C — S g l p thol ry

Fid y

J M S W NELL—9 G ne l g y dsp l n e

A E ROBI SC V— R dum th py

FLUSHING HOSPITAL

(F l h g)

T d y

G J J L RE CE—9 G Gyn c l o l p at

J W WICK —9 G l s g cal p t

J L M ISSEL— Gynec l g cal pemat

J S TROM — G l g l p rat

Th d y

J S T M S W K ROGE S d J DER COM S—9 J

Frat d m trat

G J J L RE C d J L MORRIS Y—9 J Gyn c

l g l p t

NORTH COUNTRY COMMUNITY HOSPITAL

(G l C)

T d y

A M B LL—9 Op rat b t trics

F C JE SU—9 Medi l dem trat ns

Th d y

M C H LL—9 F d t

G F HOC —9 Urol cal op rat ns

Fid y

L D LARIM —9 Laborat ry d m trat

NASSAU HOSPITAL

(M l)

T d y

W M Po r and A S WARIN—9 G e l s g ry

W L SN —9 O thop d e p at

Tl d y

H C M TIN—9 Ob t t c l gy col gy

G F CLE ORN—9 G l u g ry

J W McCHESNE —9 U l gy

F d y

G F CLEGHORN nd W S S Ho o —9 G l

u g ry

JAMAICA HOSPITAL

(R hm d H ll)

T d y

H W BARBER—9 C l g cal op t n

H C COU TEN— O th p d e p at

Tl d y

L H Mo s—9 G l l p t

A L VOLIZ— Y y fe

F d y

H W N AI —9 Gy l g l p rat

A E BAKE —9 Ob t t l p e to

H C COU V d A L VOLT — F ctu d \ ,

c nd

LUTHERAN HOSPITAL

T d y

A V P FARD M V—9 C r l g ry

N P RATHBUN—9 U log l cl

Tl d y

V V NT BARB —9 C l u ge y

CA ON DU CA —9 Gynec l gy

F d y

EDWARD M Y—9 Ob t t cs

JEWISH HOSPITAL

T d y

J HN LIND —9 G l g ry

L O S SCH VART —2 Gyn c l g alope at

Tl d y

JOHN LI D —9 G l g ry

L S S H A —2 Gyn l g cal p at

F d y

W M L NDER—9 C al g ry

ADOLPH B NNE — Gyn l g l p t

GREENPOINT HOSPITAL

T d y

A L SORES—9 G l ry

CHARLES A GORD V— Gy l cal l n e

Tl d y

JOHN SMITH JR—9 G l g y

EMIL F K C — P th l g c l d m trat

F d y

JOSEPH S BALD VL —9 G ral g ry

KINGSTON AVENUE HOSPITAL

Th d y

PAUL F H — Empty m c mple c t

g d i

SURGERY OF THE EYE EAR NOSE AND THROAT

CLINICS IN NEW YORK HOSPITALS

NEW YORK POST GRADUATE HOSPITAL

Monday

- ROBERT BUCKLEY—2 Laryngectomy or pharyngotomy for malignancy
 CLARENCE H SMITH and staff—2 Otolological operations
 E M ALGER—3 30 Eye operations and demonstration of cases
 LOUISE H MEEKER—4 Pathology of nose and throat

Tuesday

- L H MEEKER—9 Pathological lantern slide demonstration of eye cases
 C J IMPERATORI—9 Bronchoscopy
 MARVIN F JONES—9 Histological examination of the temporal bone in serial sections
 ARTHUR NILSEN—11 Ethmoid sinus operations
 G ALLEN ROBINSON—2 Demonstration of radium as a therapeutic agent
 MARVIN F JONES and staff—2 Otolological operations
 C M GRIFFITH—3 Caldwell Luc and Denker operations
 MARTIN COHEN—3 30 Eye operations and demonstration of cases

Wednesday

- JAMES W WHITE and R AEBLI—9 Eye muscle operations muscular anomalies
 VICTOR ANDERSON—9 Neck dissection and demonstration of surgical anatomy
 RAYMOND J GAFFNEY—9 Otolological operations
 ROBERT BUCKLEY—2 Laryngectomy and pharyngotomy with removal of hyoid as approach for malignancy
 GUSTAV AUFRICHT—9 Rib tran plant for nasal deformity
 CLARENCE H SMITH and staff—2 Otolological operations
 DAVID ALPERIN—3 30 Eye operations and demonstration of cases

Thursday

- L H MEEKER—9 Pathological conditions of the eye (lantern slide demonstration)
 C J IMPERATORI—9 Opaque foreign bodies (lantern slide demonstration)
 DUNCAN MACPHERSON—10 Frontal sinus operations
 MARVIN F JONES—9 Histological examination of the temporal bone in serial sections
 ARTHUR NILSEN—2 Caldwell Luc operation
 C J IMPERATORI—2 Endoscopy and laryngeal operations
 MARVIN F JONES and staff—2 Otolological operations
 MARTIN COHEN—3 30 Eye operations and demonstration of cases

Friday

- J W WHITE and R AEBLI—9 Eye muscle operations muscular anomalies
 T J HARRIS—9 Tuberculosis of larynx (lantern slides)
 R H HUTCHINSON JR—10 Cochlear audiometric and vestibular tests
 E M ALGER—3 30 Eye operations and demonstration of cases

ST VINCENT'S HOSPITAL

Monday

- JOHN D KERNAN—2 Bronchoscopic clinic

Tuesday

- JOHN M LORE—2 Bronchoscopic clinic

NEW YORK EYE AND EAR INFIRMARY

Monday

- T LAURENCE SAUNDERS—2 Ear nose and throat operations
 CLYDE S McDANNAID and TRUMAN L BOYES—2 Eye operations

Tuesday

- W W WEEKS WENDELL L HUGHES MARY LANDIS and R E MEEK—9 Demonstration of muscular anomalies visual field changes retinal detachment
 G S DIXON and I SCHWARTZ—10 Demonstration of X ray pictures of mastoid process and nasal accessory sinuses
 B W KEY W B DOHERTY A GRIMALDI B S BEACH and H VAN LAMMER—2 Eye surgery
 J MORRISSET SMITH—2 Ear nose and throat operations

Wednesday

- BERNARD SAMUELS A B REESE and F BURCHELL—9 Sympathetic ophthalmics in relation to site of wound traumatism to retina and choroid pigmentation of retina in detachment anatomy of temporal bone
 E B BURCHELL—10 Accessory sinuses relation to orbit (lantern slide demonstration) bacteriology of ear
 FRANCIS W SHIHE S P OAST S A AGATSON and JESSIE B STARK—9 Eye surgery
 STUART L CRAIG—2 Ear nose and throat operations

Thursday

- CONRAD BERENS and associates—9 Ophthalmological clinic
 E B BURCHELL Anatomy of the accessory sinus variations and relation to orbit and its contents Discussion by Conrad Berens
 WILLIS KNIGHTON Recent advances in cataract surgery with result
 E J BASSEN Glaucoma operations and results
 J MORRISSET SMITH—9 Mastoid operations anatomy of facial nerve (demonstration on cadaver)
 E B BURCHELL—9 Anatomy of temporal bone (lantern slide demonstration)
 JOHN MCCOY—2 Ear nose and throat operations
 W W WEEKS T H JOHNSON W L HUGHES and R E MEEK—2 Eye operations

Friday

- CLYDE L McDANNAID and TRUMAN L BOYES—9 Eye clinic
 G S DIXON and I SCHWARTZ—10 Demonstration of X ray pictures of mastoid process and nasal accessory sinuses
 BERNARD SAMUELS CONRAD BERENS ISADORE GOLDSTEIN and WILLIS KNIGHTON—2 Eye operation
 HUGH B BLACKWELL—2 Ear nose and throat operations

MIDTOWN HOSPITAL

Monday

- RAYMOND LOSEY—2 Ophthalmological surgery

Tuesday

- BENJAMIN FREUDENFALL—9 30 Nose and throat surgery

MISERICORDIA HOSPITAL

Tuesday

- ROBERT I BUCKLEY—2 Ear nose and throat operations

MANHATTAN EYE, EAR AND THROAT
HOSPITAL

M d

H. W. WOOTTO nd L. W. C. GILLER— Ey p rations

T d y

D. VID. JOHNS— 30 T n l c
JOHN K. PAGE nd t f—2 L rcl m
ROSS FAULKNER nd staff— N e dth t l
F. M. L— D m t t f n y
A. J. FOSTON— Dem nt at n f path l y
H. I. S. EL d G. W. FAE J— 1 y pe at n

Hed d

G. ALLEN ROBINSON—9 D m t t l e f d m
e n ndth t mlgatt m
DAVID JONES— 3 T nsl lnt
A. B. D. E. LA d st f— Ea cl
H. I. S. EL d G. W. FAE J— N dth atcl
I. M. L— 2 N y d m t t n
A. J. EGGSTON— P th l l d m st to
S. C. KEIL nd A. D. MITTENDORF— L p to s

T d y

C. J. IFFETRI— B h c p l
DAVID JONES— 3 T l n
E. P. FOYLE d st f—2 E l
FR. WHITE d st f— N e a dth tcl m
E. I. L. AIR— Cl l h f a
N. D. L. F. HE d J. S. A. FLEET— Ey
p t n

f d y

C. ALLEN ROBINSON—9 D m nt at n f u f ad m
e n dth t b p tumor
D. J. S— 3 T l n
J. R— Ea cl m
J. H. W. HE— N a dth tcl m
D. H. W. TE d M. COH— Ey t s

PRESBYTERIAN HOSPITAL

M d y

H. A. NEVERT— Ea n a dth t l c

T d

THOMAS H. JOHNS— Ey e m f t t f b a
d t
C. G. C. ALY— F ll w up l e n a d
th t c
JO. H. D. NCTO— Ey p to
L. E. K. P. RC— Ear dth at l c
JOHN K. R. V— B h py

Hed d y

DANIEL B. KIR— 0 Ey t u c ltu d m nt
t n
HAR. NEVERT— A t mcl d m t t
G. ORGE R. BRI TO— E n dth t l

T d y

JOHN M. WHEER— Res l t f y p rations
JAMES W. BOCK— F ll w up l e a d
th t
JOHN M. WHEELER— E p at n
CHRISTIAN H. E— 2 E n s ndth tcl m c

f d

JOHN H. D. NINGTO— D m o t t f y e
m l d t
P. G. NO THING O— St d af
J. H. D. T. RO— Fve perat n
GEORGE V. BROENE— Ea ndth tcl c

BELLEVUE HOSPITAL

M d y

WILLIAM B. DOHERTY and E. B. GESSER— Ly opera
t s
R. T. ATKINS—2 E n e dth t p rations

T d y

JO. V. MILLER nd T. H. MOAT—1 B ch c p c
l l
W. C. BOYERS—2 Ea and thr at p at
S. A. AGATONVA d E. A. TUSA— Ey p at n

Hed d y

WEBB W. WEEKS E. B. GRESSE nd A. L. TOWN—9
P th logical y pecim g s a d m c p
J. W. FOYLES— 1 o t p at c m st dcl c
J. V. MILLER— L r y g l c l n c
W. B. W. WEEKS W. L. I. B. DOERTY S. P. OAST nd
S. A. AGATONVA—2 Ey p t n
C. J. IMERATORI—1 B nch p c l

T d y

WEBB W. WEEKS d S. A. ATSON—9 Ophthalmol
p c
E. H. MOAT— Ant mcl d m nt t n a s
lth t p m n
J. W. FOYLES nd V. C. MCCUAGH— E os a d
th t p e at s
S. P. OAST d E. A. TUSA— Ey perat

F d y

WEBB W. WEEKS E. B. GRESSE and A. T. TVN—9
Pathol cl y p men g s a d m c p
JOHN CUTM—9 N o t l g y
LEGA M. P. RAND J. SWIFT H. LEX—2 E n s d
th t p e at
E. B. GRESSE d W. B. W. WEEKS— Eye p t s

BETH ISRAEL HOSPITAL

M d y

ALFRED A. SCHARTZ— Cl c n n e o t l g y

T d y

JOSEPH W. MILER—9 B on hosc p c d gn t cl m
L. VIN TO. A. S. SLOUA nd IRENE NEWMAN—
Eye cl m

Hed d y

M. A. GOTTLIE— E r t g y
L. A. TE C. D. RE— y D m nt at n f cl d
ph to raphy fl y e

T d y

WILLIAM S. ILLER—9 Rh l g cal gery
S. J. KOPRACK— O t l g c l p at n
E. VIN TO. A. S. SLOUA nd F. D. RICK NEWMAN—
Ey p r t

F d y

HAROLD J. ISAACS—2 N e dth tcl c

LENOX HILL HOSPITAL

Th d

J. HENKER nd G. F. OBERREDE—9 B cho p c
d
RUDOLF C. DENIG JOHN J. REID nd F. VINCE T. GUIN
—2 Ad me t (n h r g ut e orn al
lmb) l l o l r f a rat d p l p d
n t p l t t a f b u l m u m m b r a
nd t r s o f g l a m t t m e t f p t p r a t
affect n

NEW YORK POLYCLINIC HOSPITAL

Monday

WILLIAM L. GATEWOOD—2 Nose and throat operations
ERVIN TOROK—3 Ophthalmology
JOHN MCCOY and staff—4 Otolaryngology

Tuesday

LEE M. HURD—2 Nose and throat operations
C. E. McDANNALD and T. A. NORTHCOTT—3 Ophthalmology
SAMUEL J. KOPETZKY—4 Otolaryngology

Wednesday

ERVIN TOROK and JOHN RICHARDSON—9 Ophthalmological operation
WILLIAM L. GATEWOOD—2 Nose and throat clinic
JOHN MCCOY and staff—4 Otolaryngological operations

Thursday

LEE M. HURD—2 Nose and throat clinic
C. E. McDANNALD and T. A. NORTHCOTT—3 Ophthalmological operations
S. J. KOPETZKY—4 Otolaryngological operations

Friday

LAWRENCE D. REDWAY—9 Colored photography of living eye
HENRY B. ORTON—2 Bronchoscopy
ERVIN TOROK—3 Ophthalmology
JOHN MCCOY and staff—4 Otolaryngology

FLOWER HOSPITAL

Thursday

J. A. W. HUTCHICK—2 Mastoid problems
EDWIN S. MUNSON—2 Muscular imbalance of the eye
WILLIAM MCLEAN—2 Cataracts (Barraquer technique)
ARTHUR CHAMBERS—2 Ophthalmological clinic

MORRISANIA HOSPITAL

Tuesday

C. SMITH—2 Otolaryngological operations

Wednesday

T. H. CURTIS—9 Ophthalmological operations

Thursday

DAVID H. JONES—2 Bronchoscopic clinic

FORDHAM HOSPITAL

Tuesday

JOSEPH D. KELLY—9 Otolaryngological operations

Wednesday

S. H. BASCH—9 Otolaryngological operations

Friday

H. G. WINCOR—9 Ophthalmological operations

CORRECTION HOSPITAL

Monday

JAMES W. SMITH—2 Ophthalmic surgery

Friday

JOSEPH ROSENBERG—9 Ear, nose and throat clinic

ST. MARY'S HOSPITAL

Wednesday

JAMES W. BADCOCK—9 Ear, nose and throat conditions in children

MT. SINAI HOSPITAL

Monday

SIDNEY YANKAUER, MERWIN MYERSON and RUDOLPH KRAMER—2 Bronchoscopy
J. WOLFF K. SCHLIEK and I. GOLDSTEIN—2 Eye clinic

Tuesday

I. FRIESNER, J. MAYBAUM, WALTER HORN, S. ROSEN, JOSEPH G. DRUSS and HARRY ROSENWASSER—9 Ear operations and demonstration of cases
I. GOLDSTEIN—10 Ocular pathology
SIDNEY YANKAUER, MERWIN MYERSON and RUDOLPH KRAMER—2 Nose and throat clinic

Wednesday

I. FRIESNER, J. MAYBAUM, WALTER HORN, S. ROSEN, JOSEPH G. DRUSS and HARRY ROSENWASSER—9 Ear operations and demonstration of cases
R. LAMBERT—10 Fundus photography

Thursday

I. GOLDSTEIN—10 Ocular pathology
SIDNEY YANKAUER, MERWIN MYERSON and RUDOLPH KRAMER—2 Bronchoscopy
J. WOLFF K. SCHLIEK and I. GOLDSTEIN—2 Eye clinic

Friday

H. MINSKY—10 Improved method of focal illumination and transillumination
SIDNEY YANKAUER, MERWIN MYERSON and RUDOLPH KRAMER—2 Nose and throat clinic

ST. LUKE'S HOSPITAL

Monday

WESTLEY M. HUNT—2 Nose and throat clinic
ALFRED WIENER, ISAAC HARTSHORNE, CHARLES LITVIN, HENRY SMITH and RAYMOND E. MEEK—2 Eye clinic

Tuesday

CARL M. SAUTTER—2 Ear clinic
L. T. PERRAULT and W. M. HUNT—2 Bronchoscopic clinic
ALFRED WIENER, ISAAC HARTSHORNE, CHARLES LITVIN, HENRY SMITH and RAYMOND E. MEEK—2 Eye operations

Wednesday

A. P. VOISLANSKY and staff—2 Nose and throat operations

ALFRED WIENER, ISAAC HARTSHORNE, CHARLES LITVIN, HENRY SMITH and RAYMOND E. MEEK—2 Eye clinic

Thursday

WESLEY C. BOWERS and staff—2 Radical mastoid with primary skin graft

Friday

ALFRED WIENER, ISAAC HARTSHORNE, CHARLES LITVIN, HENRY SMITH and RAYMOND E. MEEK—2 Eye clinic

KNAPP MEMORIAL EYE HOSPITAL

Tuesday

ARNOLD KNAPP and staff—2 Eye operations

Wednesday

ARNOLD KNAPP and staff—2 Eye operations

Thursday

ARNOLD KNAPP and staff—2 Eye operations

LICHTHOUSE EYE CLINIC

T d y

CONRAD BE NS—Op at slo t l d t chm nt
(l t m l d d m t r a t)
H J R SS—Relat n f d n t l n f c t s t d s es
f th y (l te l d demo t t)
P L T Co OLLY d L N A TUSAK—Dem n
t t f u s l c l cal d p t u s

Hed d y

CONRAD BE NS—Op e t f het ot p nd
h t ph n t o p l c m e t r e s e t n d t not my
f f e r b l q u (l a n t m s l d e d m o t t)
LEGRAND H II Y—P c t a l p m t s n p n m e t r y
a d a m p m t r y (l te l d dem s t a t o)
ADO POS E—l m b r y l g c t r p e t a t f e
t d l p m n t l n o m l s f th y e (l n t e r s l d
d m n t t o)

Th d y

J MRS M EVA S—Rel t f u p p p u r a t r y l
t t d f y e (l a n t m l d d m n t
t)

ELIZ ETI A ST K—O Cl cal p n m e t r y (l a t e r n
l d d m t t)

F N A T S I A K—Cl cal n d t f c u l t
m

F d y

CO RAD B d EL A E T K ST K—Ocul
f t g u (l a t r r s l d e d m n t t n)
P T C NN L d DORO IV A SN—Oth p t c
t
OLO S C R S A A—K t o n d e c t e t l
t h p t t of

LEBANON HOSPITAL

M d y

M D I E M A d I S A M H I L E R—O t l y
h l e y

F d

M D L R M N d I S A M H I L E R—O t l r y n
h l e y

CITY HOSPITAL

M d y

A N S c n l e — E n a d t h t c h

Th d y

O C R I S C H—E a a d t h t l l

LINCOLN HOSPITAL

T e d y

J S HANLEY—O t l y g l a l p t n

T l d y

H F L I G T r a d M B R G E R—O t l a r y n g l g l
P t

METROPOLITAN HOSPITAL

T e l v

A L C A M RS—4 S g y f t h e y e

T l d

J A W I I T R C K d t a f f—S g r y f t h n
t h a t d

BRONX HOSPITAL

M d y

N C O O P F E N D—O p h t h l m l g y

W d d y

M J B A L L N—2 O t l r y g l y

T l d y

M J B A L I N—O t l a r y l r y

FIFTH AVENUE HOSPITAL

T l d y

W L E Y M H U N T—O t l a r y g l g l p t a l
d m o t t f a e

F d

L E C N D H H A R a d Z H I t—O p h t h l m
l g e l p t d d m t t t f

GOUVERNUR HOSPITAL

F d y

W I A M L C E W O D—N e d t h t c h n

HARRIS HOSPITAL

H e d n d

L H U R Y—O t l r y l g y

HOSPITAL FOR JOINT DISEASES

T d y

A L R E D B A C—4 F n s d t h o t p r a t

SPECIAL CLINICS FOR BROOKLYN LONG ISLAND DAY—WEDNESDAY

BROOKLYN EYE AND EAR HOSPITAL

R L M O O R d d t f f—O p e r a t n S m p l d
r a d c a l m t o d n p a t s l c l n d g l
a a t h t l l t m y d d n o d t m y l l
l g l a e s t h e s b n c h p v

J A N E—O I d c a s e s l t l m p d m n t
t e s h l a b o r a t r y d m n t r a t

D F—O P t h l g a l d e m n t a t

C H A L E S F R A N K E N B U R G—O P b l m o f p h y l a x i

P t h l g a l p e c i m n s l d p h t h l m o l g a l w k

G O B A T I S C H—O l d G r m o p h t h l m l g y

J A N O N—O L a t l d d m n t t

R L P H I L L O D—O P r o p t s d g t e p b l m

T U R N A G I E N d s t f f—O S y p h i l u s n d t h y e

D R D E V E R—2 P t h l m o l d m n t t

D R S C R A E L A S H E R B R A S L N C I L S S C O I I D

D U K E E A D O M S P O O L T U C K E H E E R C A M

E O N M C C A M M O N A J R D A a d D E L O A N N A—

D m t r a t o n f c a f l y r n e c t o m y r t f a l

l r y b a b m n n g t p t o t

R R E I D C H—2 P b l m f a n a p h y l a p t h l o g l

p e c m n X y d g n l p t h l g y f t h

m a t d d p t r o p y r a m d p o t e a d

p t e c l

T H U M A N G I E N d s t a f f—S y p h l c h i l d

P C H A M E S J A M E S O N—2 R e c n p t n

J A N O N—C a t a t

J A M S I I A N D E W S—G l m a p e t

E C L I F F O R D P L A C E—G l p h t h l m c g y

D R S R E Y N S W A U G B H O P B E d H A T T—

O p h t h a l m l g c a l s g r y

LUTHERAN HOSPITAL

- A GILLIGAN P KEIL L M MacDOUGALL G T POLK
J L STACK and M SKINNER—9 Ear nose and
throat clinic
A GILLIGAN and G T POLK Bronchoscopy nasal sinus
surgery ear functional tests
I KEIL and J E STACK Tonsillectomy under local anes-
thesia submucous resection nasal sinus diagnosis
I M MacDOUGALL and M SKINNER Tonsil and adenoid
clinic mastoidectomy nasal surgery

ST PETER'S HOSPITAL

- JOHN HAUFF Treatment of the faucal tonsils by physio-
therapy
ALBERT KEENAN Conservative treatment of diseases of
the accessory nasal sinuses

ST JOHN'S HOSPITAL

(Lon Island City)

- PATRICK J KENNEDY—1 Secondary operation for mas-
toid new technique in removal of septum

ST MARY'S HOSPITAL

- Staff—9 Ear nose and throat operations
H F WILKINSON—2 Pathology of 1000 pairs of
tonsils

WYCKOFF HEIGHTS HOSPITAL

- KARL MUELLER JR—2 Diathermic treatment of
tonsils

CUMBERLAND HOSPITAL

- F H LASHER and staff—2 Symposium on diseases of the
ear nose and throat

NORTH COUNTRY COMMUNITY HOSPITAL

(Glen Cove)

- G H COX I T JACKMAN and DR SCOTT—12 Nose and
throat clinic

CONEY ISLAND HOSPITAL

- T B WOOD Cerebral complications of otitis media

BROOKLYN HOSPITAL

- C G CRANE J H TAYLOR and F H LASHER—2 Nose
and throat operations

BUSHWICK HOSPITAL

- L C MURGER and staff—6 Ear nose and throat op-
erations

CLINICS IN BROOKLYN AND LONG ISLAND HOSPITALS

JEWISH HOSPITAL

Tuesday

- EDWARD L BERGER—2 Nose and throat operations

Thursday

- EDWARD L BERGER—2 Nose and throat operations

Friday

- PHILIP LEIBOWITZ—2 Nose and throat operations

BROOKLYN HOSPITAL

Friday

- C G CRANE—2 Ear nose and throat operations and
bronchoscopic clinic

CALEDONIAN HOSPITAL

Tuesday

- JOHN W DURKEE—2 Otolaryngology

Thursday

- JOHN W DURKEE—2 Otolaryngological operations

CUMBERLAND HOSPITAL

Tuesday

- JOHN H BULFIN and staff—2 Eye clinic operations and
demonstration of cases

JAMAICA HOSPITAL

(Richmond Hill)

Thursday

- A J SHEKTER—2 Eye ear nose and throat clinic

LUTHERAN HOSPITAL

Tuesday

- A GILLIGAN—9 Otolaryngology

Thursday

- A GILLIGAN—9 Otolaryngology
LEON W GREFY—2 Ophthalmological clinic

Friday

- PETER KEIL—9 Otolaryngology

KINGS COUNTY HOSPITAL

Tuesday

- J W DURKEE and M G GOLDEN—9 Otolaryngology

LONG ISLAND COLLEGE HOSPITAL

Tuesday

- C W STICKLE—2 Laryngology
H M SMITH—2 Ophthalmology

MARY IMMACULATE HOSPITAL

(Jamaica)

Tuesday

- DANIEL S CUNNING—9 Nose and throat clinic

METHODIST EPISCOPAL HOSPITAL

Friday

- C L STONE C A ANDERSON E A SUNDE and H
GLEDHILL—2 Otolaryngology

ST JOHN'S HOSPITAL

T d y
 J IN P B AK — Ot l r yn l gy
T d y
 JOH N B KER — Ot l r yn l gy
F d y
 RO ERT L MOORE HEAD — Ot l ar yn g l gy

NASSAU HOSPITAL

(M l l)
F d y
 H B SM — No e nd th t l

NORTH COUNTRY COMMUNITY HOSPITAL

(Gl n C l)
F d y
 G H C — No e and th t p rat n

ST CATHERINE'S HOSPITAL

T d y
 S H D C — E n and th t l
T d
 G GARY WAI L F SHER — Fr nd th o t cl

WYCKOFF HEIGHTS HOSPITAL

Tu d y
 ROBERT L MOORE HEAD — No e and th o at cl n c
 CARL MUELLER SR — 3 Oph th l m l o g al p er at on
T d y
 ROBERT L MOORE HEAD — No e nd th at cl n c
 CARL MUELLER SR — 3 Oph th l m l o g al p er at on
F d y
 CARL H MUELLER JR — No e d th at cl n
 IRVIN CAMERON — 3 No e and th o t l n

ST JOHN'S HOSPITAL

(Lo g l l d C ty)
F d y
 P J KENNEY — No e and th t p rat n

ST PETER'S HOSPITAL

T d y
 A KEENE — No e and th at cl
Tu d y
 M G GOLDEN — No e nd th at cl n c

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THE RÔLE OF THE PANCREATIC JUICE IN THE PRODUCTION OF GALL-BLADDER DISEASE¹

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Ass't Prof. of Surg. in Northwestern Univ. by Att'd. Surgeon P's. in the Hospital

A CAREFUL study of the pathological findings in gall bladder disease encountered either in the operating room or on the autopsy table often suggests the possibility of an unknown etiological factor. Moreover, the clinical history often suggests a factor which must by nature of its sudden and rapid action be more than an inflammatory process. This is especially true in cases of acute gangrenous cholecystitis and in some cases of acute phlegmonous cholecystitis in which the gall bladder yields sterile cultures. Clairmont and Haberer have described cases of non perforative biliary peritonitis. Schultze suggested a disturbance such as is associated with acute pancreatic necrosis and Walzel having in mind the work of Blad and Schoenbauer suggested that the pancreatic juice might be the active factor since he was able to demonstrate the presence of pancreatic ferments in the gall bladder contents in a case of acute phlegmonous cholecystitis.

In 1928 I was asked to operate upon a patient who was suffering from an attack of subacute pancreatitis. In this case the gall bladder was distended, the wall was oedematous and much thickened, the serosa was a dusky cyanotic red and in every way it gave the gross appearance of an acute phlegmonous cholecystitis. The microscopical examination of the organ verified this diagnosis but cultures taken from the gall bladder wall and the con-

tents of the gall bladder were sterile. The picture was so obviously one of acute inflammation that I began to speculate as to a possible cause for an aseptic phlegmon of the gall bladder. The reference by Walzel which had just come to my attention was recalled and stimulated me to a further study of the subject.

When I began my experiments in January of 1929 I was not acquainted with the studies of Blad, Schoenbauer, Westphal and others. My experiments were gradually developed in an effort to determine whether pancreatic juice if conveyed into the gall bladder of the dog would produce pathological changes in the wall of the gall bladder. It is a known fact that pancreatic juice will attack living tissues under favorable conditions as exemplified in the widespread digestion of the abdominal wall in cases of pancreatic and duodenal fistula; therefore it seemed plausible to me that if pancreatic juice came in contact with the gall bladder wall it might produce pathological changes not unlike those seen at times on the operating table.

EXPERIMENTAL STUDY

Our experimental work was carried out on the dog, all animals being operated upon with the animal under ether anesthesia, strict aseptic technique being employed. The experiments can be divided into five groups: (1)

¹ With Lab. try. of S. G. Res. in the West. Univ. by Ch. R. Def. in the Chicago Soc. of Med. & Surg.

a single injection of pancreatic juice into the gall bladder through a hypodermic needle (2) multiple injections of pancreatic juice into the gall bladder through a cholecystostomy tube (3) a single injection of pancreatic juice into the cystic duct through a hypodermic needle (4) a single injection of pancreatic juice into the common duct through a hypodermic needle (5) the continuous introduction of pancreatic juice into the common duct by means of special preparations. The pancreatic juice employed in these experiments was obtained by cannulating the major pancreatic duct of the dog and collecting the juice in a rubber bag.

Group 1 1 single injection of pancreatic juice into the gall bladder through a hypodermic needle. Eight animals were subjected to this procedure. The usual technique was to open the abdomen through a right paramedian incision the gall bladder being delivered and a pursestring suture of fine silk placed at the apex of the viscus. A fine hypodermic needle was introduced and from 10 to 20 cubic centimeters of bile was aspirated and a like amount of pancreatic juice was injected no force being used. The pursestring suture was drawn taught and tied as the needle was withdrawn thus preventing leakage of the contents of the gall bladder. The abdomen was closed in four layers. Two of these animals died during the first 3 days the cause of death being acute peritonitis with bile stained bloody fluid in the peritoneal cavity with no gross leakage from the gall bladder. Specimens were taken from the others at varying periods of time up to 67 days after the procedure (Dogs 7 8 9 15 18 19 21 22).

Group Multiple injections of pancreatic juice into the gall bladder through a cholecystostomy tube. There were only two animals in this group because we believed that the trauma incident to this procedure would add a factor which would be difficult to evaluate in forming final conclusions. The operation was performed as in the human care being taken to prevent possible leakage about the tube. One animal dog 6 was killed 7 days after the operation having received six injections of 20 cubic centimeters each of pancreatic juice at 24 hour interval beginning on the day of the opera-

tion. At the conclusion of the experiment the animal was apparently in good condition. Dog 16 died 3 days after the operation having had three daily injections of 20 cubic centimeters each of pancreatic juice the first being on the day of the operation.

Group 3 A single injection of pancreatic juice into the cystic duct through a hypodermic needle. Only two animals were subjected to this procedure for because of the danger of leakage from the puncture wound in the duct it seemed impossible to close the puncture wound without danger of obstructing the duct. Both animals died within 24 hours after the operation. In dog 17 15 cubic centimeters of pancreatic juice was injected into the cystic duct after a like amount of bile had been aspirated. Due to leakage from the puncture wound an attempt was made to place a purse string suture about the opening but at autopsy after separating adhesions a leak was encountered. In dog 20 after aspirating 15 cubic centimeters of bile a like amount of pancreatic juice was injected and due to leakage a fine silk pursestring ligature was necessary. At autopsy it appeared that the ligature obstructed the cystic duct.

Group 4 A single injection of pancreatic juice into the common duct through a hypodermic needle. There were only two animals subjected to this procedure because of the persistent leakage from the puncture wound. In dog 14 after aspirating 10 cubic centimeters of bile from the common duct 20 cubic centimeters of pancreatic juice was introduced. It was noticed that the gall bladder was moderately distended after this procedure. This animal died on the fifth day after operation. Dog 3 after having had 15 cubic centimeters of pancreatic juice injected into the common duct died within 24 hours. In this animal it appeared at autopsy that the common duct had been obstructed by the ligature which had been placed to prevent leakage.

In this group may be placed dog 1. In this experiment a T tube was placed in the common duct and 22 days after the operation daily injections of 20 cubic centimeters each of pancreatic juice were made for a period of 6 days. Nine days after the last injection the animal was killed. At this time the animal

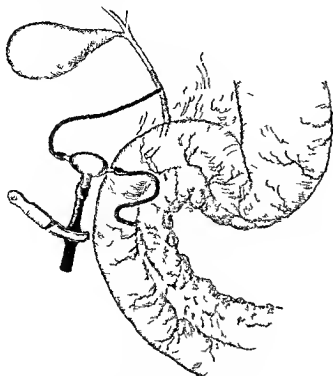


Fig. 1. Cholelocho pancreatic intubation. A drawing to illustrate the T tube in the common duct and a cannula in the pancreatic duct. The two tubes are connected by an observation glass bulb which is outside the abdominal cavity.



Fig. 2. A photograph depicting the external connection in Figure 1. The tube on the left side of the abdominal wall connects with the pancreatic duct; the one on the right with the common duct. They are joined by the observation bulb.

was markedly emaciated and very weak. At autopsy the duodenal end of the T tube was found occluded and the duct completely stenosed at this point.

Group 5. The continuous introduction of pancreatic juice into the common duct by means of special preparations. It seemed that none of the four methods so far employed were free from error so far as determining the effect pancreatic juice had on the gall bladder. Trauma to the gall bladder could not be excluded as a distinct factor in the production of possible pathological changes in the gall bladder; moreover, we did not believe that one injection of pancreatic juice would constitute a fair test as to the possibility of its producing pathological changes. It was calculated that if pancreatic juice found its way into the gall bladder of the human, it would most likely be introduced into the terminal end of the common duct and from there ascend in the common duct to the gall bladder. Furthermore, it seemed likely that the pancreatic juice would be introduced into the common

duct in relatively small amounts intermittently over a period of time.

With these conditions and theories in mind a new series of experiments were planned. The



Fig. 3. Photograph of gall bladder of dog 56 in which black India ink had been placed in observation bulb in a cholelocho pancreatic intubation. Appearance 5 days after operation. Upper left shows filter paper; lighter color due to gall bladder itself; black area in center due to ink.

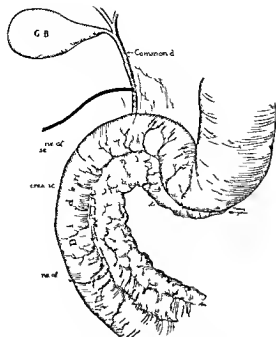


Fig. 4. Dog's abdominal cavity showing the pancreas and common duct. A glass cannula (GB) is inserted into the common duct. The pancreas is shown with its duct system. Labels include 'GB', 'Common duct', 'pancreas', and 'duodenum'.

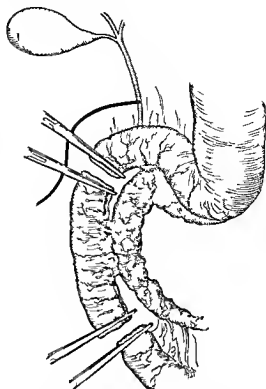


Fig. 5. Dog's abdominal cavity showing the pancreas and common duct. A glass cannula (GB) is inserted into the common duct. The pancreas is shown with its duct system. Labels include 'GB', 'Common duct', 'pancreas', and 'duodenum'.

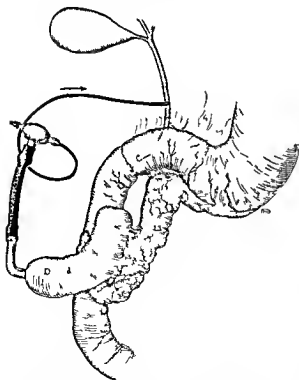


Fig. 6. Dog's abdominal cavity showing the pancreas and common duct. A glass cannula (GB) is inserted into the common duct. The pancreas is shown with its duct system. Labels include 'GB', 'Common duct', 'pancreas', and 'duodenum'.

first preparation we called a choledochopancreatic intubation. The abdomen of the dog was opened through a right paramedian incision and a T tube placed in the duodenal end of the common duct. The major pancreatic duct was then isolated and freed. A small glass cannula attached to a rubber tube was fastened into the orifice of the pancreatic duct as in making a pancreatic fistula for obtaining pancreatic juice (Fig. 1). The pancreatic tube was brought out of the abdomen through a small stab wound on the left side of the abdomen and the common duct tube through a similar wound on the right side. The midline incision was then closed in the usual manner. The two tubes were then connected by means of a glass connecting bulb (Fig. 2). This bulb afforded a means of determining whether the tubes remained patent and whether a flow was present. Since Harms and Dragstedt¹ have

¹ D. G. Harms and J. Dragstedt, "The Pancreatic Intubation," *Ann. Surg.*, 1914, 60, 1-10.

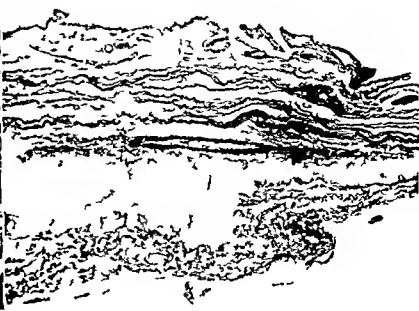


Fig. 7 left. Photomicrograph of wall of gall bladder of dog 17 which died 1 day after the injection of 15 cubic centimeters of pancreatic juice into the cystic duct. The wall is much thickened, 4 millimeters, and shows diffuse necrosis with edema. No viable structures can be seen nor can any structures be identified. $\times 30$

Fig. 8 Photomicrograph of the wall of the gall bladder of dog 33 which died 1 day after a choledochopancreatic intubation. There is complete necrosis but it is possible to identify the several layers of the gall bladder wall. The wall was but little if any thickened. $\times 48$

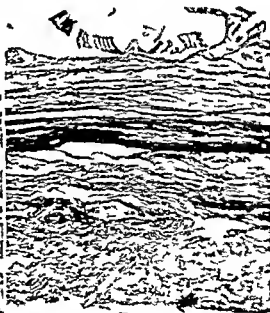


Fig. 9 left. Photomicrograph of gall bladder wall of dog 9 which was killed 20 days after the injection of 20 cubic centimeters of pancreatic juice into the gall bladder. The mucosa is necrotic and parts sloughed away. The section shows an intense infiltration of the inflammatory cells into the submucosa and muscular layers. The serosa is also infiltrated and very much thickened. $\times 75$

Fig. 10 Photomicrograph of the gall bladder wall of dog 56 which died 6 days after a choledochopancreatic intubation with black ink in the observation bulb. This is a section of the gall bladder shown in Figure 3. The animal was autopsied immediately after death. Shows widespread necrosis with thickening of the serosa with edema. Fragments of the mucosa can still be seen and there is some inflammatory cell infiltration of the serosa. $\times 45$



l ft Ph t m ph f w ll f g ll bl dd c
f l g 6 wh h d d 3 d 3 s ft th j t f o
b t m t f p t c j t th g ll bl dd
Th m hyp rpl t c d sh ws id f c
Th th ly h h e c de bly th k ed l
h w t c X3

I g Ph t m g aph f th of th g ll bl d
d o d 48 h h d d d ys ft ch l d h pa c t
tub to O th l ft ca b d l t d bl d l
w th p l f l t t Th p t e t
ec th ced m d m ll l f l t to
X 65

shown that the pancreatic secretory pressure is greater than that of the biliary system we believed that the flow would be from the pancreas to the common duct. This we found to be true in every case in which the tubes or cannulas remained unobstructed. Twenty



l 3 I h t m raph f th l of th g ll bl dd
f l g 8 wh h l d 4 h ft th j t f
b t m t f p t c j t th g ll bl dd
Th bevi lym h d hyp rpl s f l h m
th fl mm t y ll l t l Th hlt t l d
t th m scul l Th sa m h th l l w th
ced m d t l t r a t X3

seven animals were subjected to this procedure. The question to arise now was whether the pancreatic juice which was conducted into the terminal end of the common duct would pass directly into the duodenum and thus not come in contact with the gall bladder or would find its way into the gall bladder from time to time. Many tests using the starch iodine method were made on the contents of the gall bladder in an effort to determine the presence of amylase. But due to the confusing color reactions from iodine and biliary pigment contact we could never be assured of a positive reaction. In order to determine definitely whether the pancreatic juice thus conveyed into the common duct would find its way into the gall bladder the observation bulb was filled with India ink at the time of the operation. Black and red ink were used. It was found that as early as 48 hours after such an operation the observation bulb would contain clear pancreatic juice. It was our belief that the ink would stain the tissues with which it came in contact and therefore our animals were allowed to live from a few days to 2 weeks. The first animal dog 49 was autopsied 14 days after the operation in which black ink was used. The

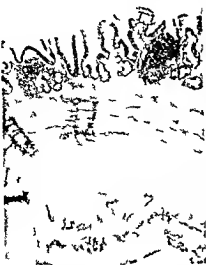


Fig. 14

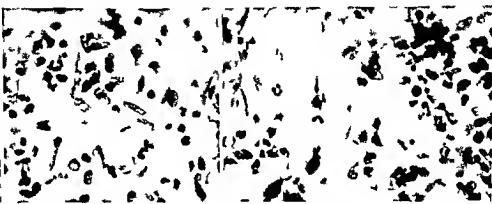


Fig. 15

Fig. 16

Fig. 14 Photomicrograph of the wall of the gall bladder of dog 27 which came to autopsy 6 days after a choledochopancreatic intubation. The mucosa is hyperplastic with lymphoid hyperplasia. The muscular layer is thickened but not so much as the serous. There is extensive inflammatory cell infiltration of all the layers. $\times 25$

Fig. 15 Photomicrograph showing leucocytic infiltration into the stroma of the mucosa. Gall bladder of dog 58 which was killed 7 days after choledochopancreatic intubation. $\times 440$

Fig. 16 Photomicrograph showing inflammatory cell infiltration into the serosa. High power of Figure 14



Fig. 17



Fig. 18



Fig. 19

Fig. 17 Photomicrograph of the wall of the gall bladder of dog 62 which was killed 33 days after a choledochopancreatic intubation. The tubes being in place for 10 days. There is extensive lymphoid hyperplasia with hyperplasia of mucosa and some thickening of muscular layer. $\times 13$

Fig. 18 Photomicrograph of the wall of the gall bladder of dog 6 which was killed 21 days after a choledochopancreatic intubation. The vessels are enlarged and there is some hyperplasia of the mucosa. High power shows inflammatory cell infiltration of mucosa. $\times 35$

Fig. 19 Photomicrograph of the wall of the gall bladder of dog 21 in which the organ was removed from the living animal 67 days after the injection of 20 cubic centimeters of pancreatic juice into the gall bladder. There is hyperplasia and hypertrophy of the mucosa with increase in the lymphoid material. All layers are thickened. There is an increase in the vascularity with perivascular infiltration and a diffuse edema with inflammatory cell infiltration. $\times 25$

gall bladder contained a slate colored material and the question still remained whether the color was produced by the black ink. In dogs 53 and 54 red ink was used and these showed

2 and 3 days after operation areas of the gall bladder mucosa which to say the least were very suggestive of reddish discoloration. Dog 56 in which black ink was used was autopsied

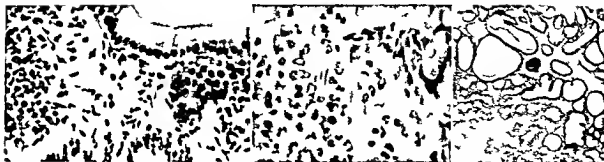


Fig 1

Fig 1 Photomicrograph of the mucosa of the gall bladder showing inflammatory cells.

Fig 2

Fig 2 Photomicrograph showing hyperplasia of the mucosa with retention cysts and inflammatory cell infiltration of the gall bladder.

Fig 3

Fig 3 Photomicrograph showing inflammatory cell infiltration of the mucosa of the gall bladder.

Fig 3 Photomicrograph showing hyperplasia of the mucosa with retention cysts and inflammatory cell infiltration of the gall bladder.

5 days after operation and in this case the gall bladder was filled with a dense black material which was without question the black ink from the tube. The mucous membrane was stained a diffuse black (Fig 3) and the duodenal contents were discolored as was the gall bladder content. This experiment convinced me that fluids introduced into the terminal end of the common duct would find their way into the gall bladder and further I believed that in the preparation as described lay our means to determine the effect of pancreatic juice upon the untraumatized gall bladder.

In studying the details of this preparation the question arose as to whether the stenosing effect of the T tube might bring about secondary changes in the biliary tract and gall bladder since Ivy and Walsh have shown that by constricting the common duct of the dog pathological changes will occur in the gall bladder. These changes are characterized by lymphoid and papillary hyperplasia of the mucosa but they do not as a rule take place for from 4 to 6 months. Ivy and Walsh have also produced stasis in the biliary tract due to reverse gut peristalsis by making a reversed duodenal loop. The pathological changes in these cases were practically the same as in the duct stenosis and occurred after a considerable period of time. In 3 animals we placed a T tube in the common duct ligating the long arm of the tube and placing it in the peritoneal cavity. These animals were autopsied from 14

to 26 days after the operation. The microscopical changes in the wall of the gall bladder were insignificant but there was a distinct increase in the mucoid material in the contents.

The second type of preparation consisted in making a duodenal pouch into which the pancreatic juice drained. The proximal end was closed and the distal end cannulated. The continuity of the intestinal tract was reestablished by an end to end anastomosis between the upper segment of the duodenum containing the common duct opening and the proximal end of the jejunum. A T tube was then placed into the common duct and the abdomen closed. The long arm of the T tube and the duodenal tube were externally connected after the method of the previous experiment (Figs 4, 5 and 6). With this preparation we felt assured that the pancreatic juice which was conveyed into the common duct would be activated juice. Three animals were subjected to this procedure. All of the animals died in less than 24 hours with extensive destructive changes throughout the entire abdomen.

A clinical study of all the animals subjected to these various procedures revealed the fact that they could be divided into three groups. In the first group the dogs died within the first 12 hours the cause of death being acute peritonitis with bile stained bloody fluid in the peritoneal cavity. In some instances there was

evidence of a limited amount of fat necrosis. In the second group the animals appeared in good condition for several days after the operation the first symptom being loss of appetite which was followed by rapid loss of weight weakness and diarrhoea death occurring in from 3 to 8 days. Autopsies done after death uniformly showed early and extensive decomposition of the abdominal viscera. Those animals which were killed during their apparent terminal illness showed varying degrees and types of pathology. In some the belly was filled with bile stained bloody fluid with evidence of peritonitis while others showed fat necrosis with evidence of upper abdominal peritonitis only. A few showed practically no peritoneal pathology but as a rule there were adhesions about the site of operative interference. The third group developed a moderate degree of indisposition after the operation but survived the condition.

THE GALL BLADDER

The pathological studies were devoted almost entirely to the gall bladder. In all cases in which cultures were taken from the contents of the gall bladder they were positive the predominating organisms being the staphylococcus and the colon group but in some instances unidentified organisms were found. Not infrequently there was a mixed infection. In every instance the gall bladder showed distinct pathological changes a normal gall bladder was never found in a case in which the preparation or procedure was successful. One or both of two basic or essential types of changes were always present either degenerative or regenerative. The degenerative change was characterized by necrosis. In the accepted animals 17 showed complete necrosis of the gall bladder wall while 8 showed incomplete necrosis with some evidence at times of reparative effort. In 19 animals the changes were classed as regenerative this group including hypertrophic hyperplastic and inflammatory reactions.

Degenerative changes. Of the 17 animals in which complete necrosis of the gall bladder was found 7 died in less than 24 hours after the operation. Three of these had a duodenal pouch with activated pancreatic juice con-

veyed into the common duct (dogs 57 59 and 60) one dog 23 had 15 cubic centimeters of pancreatic juice injected into the common duct one, dog 17 had 15 cubic centimeters of pancreatic juice injected into the cystic duct and two, dogs 33 and 40 had a choledochopancreatic intubation. Two animals dogs 28 and 34 died 2 days after a choledochopancreatic intubation dog 28 dying of pneumonia. Dog 51 in which a choledochopancreatic intubation with black ink had been done was killed at the end of 2 days. Four animals died 3 days after operation. One animal dog 15 had 15 cubic centimeters of pancreatic juice injected into the gall bladder and 3 animals dogs 31 37 and 44, had choledochopancreatic intubations, dog 37 being autopsied immediately after death. Dog 14 which had 20 cubic centimeters of pancreatic juice injected into the common duct died in 5 days and dog 29 on which a choledochopancreatic intubation had been done died in 9 days. Dog 36 on which a choledochopancreatic intubation had been done was killed at the end of 14 days when it was in very poor physical condition.

The gross appearance of the partially or completely necrotic gall bladder was very misleading. In some instances there was no question but that the organ was gangrenous but frequently the only evidence was a thickening of the wall the serosa and mucosa appearing fairly normal. The contents as a rule were either blood stained dirty yellow or thick and black with a heavy sediment. There was an excess of mucoid material and in one animal dog 29 a clumpy material was found which looked like the precalculous material in the human gall bladder. The gall bladder of dog 23 was emphysematous and much thickened.

The microscopical examination of these specimens revealed two types of necrosis. In one the wall of the gall bladder was much thickened and no identification could be made of the various component structures in the wall. There was evidence of edema and loss of all cell structure (Fig. 7). In the other type the various structures could be identified although no nuclei were present and as a rule the wall was but little thickened (Fig. 8).

Of the 8 animals in which incomplete necrosis of the gall bladder was present one, dog 7

died 14 hours after the injection of 20 cubic centimeters of pancreatic juice into the gall bladder one dog 20 died 2 days after the injection of 15 cubic centimeters of pancreatic juice into the cystic duct 2 animals dogs 30 and 53 died 3 days after choledochopancreatic intubation and another dog 16 died 3 days after the injection of 20 cubic centimeters of pancreatic juice into the gall bladder Dog 56 died 6 days after a choledochopancreatic intubation with black ink in the observation bulb and was autopsied immediately after death. This specimen showed the black discoloration of the mucosa of the gall bladder (Fig 3) Dog 48 died 7 days after a choledochopancreatic intubation and dog 9 was killed 19 days after the injection of 20 cubic centimeters of pancreatic juice into the gall bladder.

The histological changes in the wall of the gall bladder in this group were very interesting since they form the connecting link between the state of complete necrosis and the state of regeneration. In some instances only an occasional nucleus could be seen as in dog 7 which died 14 days after the injection of 20 cubic centimeters of pancreatic juice into the gall bladder. In other cases a few leucocytes could be seen with often a marked thickening of the serosa the latter being due to edema inflammatory cell infiltration and an increase in the number of young connective tissue cells. In several cases it was noted that the necrotic process seemed to extend from the mucosa outward the serosa thickening as the process advanced (Fig 9). This was pronounced in dog 30 which died 3 days after a choledochopancreatic intubation and in dog 56 which died 6 days after the same procedure (Fig 10). As early as the third day the mucosa has shown signs of hyperplasia with necrosis (Fig 11). It was noticed in one instance that the walls of the blood vessels were preserved and there appeared considerable perivascular infiltration the remaining parts of the wall having undergone necrosis although a considerable number of inflammatory and young connective tissue cells could be seen throughout the outer parts of the wall (Fig 12—dog 48 7 days after a choledochopancreatic intubation).

Regenerative changes. Of the 19 animals in which the changes in the wall of the gall blad-

der were classed as regenerative one dog 8 was killed 1 day after the injection of 20 cubic centimeters of pancreatic juice into the gall bladder one dog 54 was killed 3 days after a choledochopancreatic intubation with red ink in the observation bulb one dog 32 was killed 4 days after choledochopancreatic intubation the animal being moribund one dog 64 was killed 4 days after a choledochopancreatic intubation one dog 66 was killed 5 days after a choledochopancreatic intubation two animals came to autopsy on the sixth day after choledochopancreatic intubation dog 7 died and dog 68 was killed. Dogs 41 and 50 died 7 days after choledochopancreatic intubation and dog 47 was killed 12 days after the same procedure. Dog 49 died 14 days after a choledochopancreatic intubation with black ink in the observation bulb and dog 61 was killed 21 days after an intubation. Dog 6 was killed 26 days after cholecystostomy 20 cubic centimeters of pancreatic juice having been introduced into the gall bladder through the tube at the time of the operation and on the succeeding 5 days. The dog was in good condition at the time of the conclusion of the experiment. Dog 62 was killed 33 days after choledochopancreatic intubation. In dog 1 a T tube was placed in the common duct and 22 days later daily introductions of 20 cubic centimeters each of pancreatic juice were made into the common duct through the tube for a period of 6 days. The animal was killed 9 days after the last injection. Dog 18 was killed 57 days after the injection of 15 cubic centimeters of pancreatic juice into the gall bladder and dog 21 was killed 67 days after the injection of 20 cubic centimeters of pancreatic juice into the gall bladder. Dog 43 was killed 175 days and dog 35 187 days after choledochopancreatic intubation.

The gross appearance of the gall bladder in this group varied considerably. Some were moderately distended but the largest percentage were contracted. The color with few exceptions was opaque grayish white and in many instances there was dilatation of the vessels of the serosa. The wall was thickened in practically every instance. The appearance of the mucosa also varied but the most con-

sistent finding was a definite grayish network on a pink base. This finding was interpreted as hypertrophy of the mucosal folds. At times plaques of light yellow or gray color appeared. These plaques seemed to lie just under the surface epithelium. Occasionally the mucosa appeared velvety or granular. The contents of the gall bladder ranged from black to light yellow bile as a rule with a sediment which was either a heavy chunky material or a fine black granular material which felt like fine sand. In the majority of cases there was an excess of mucoid material. Cultures were positive in all cases in which a bacteriological study was made: the colon group and the staphylococcus being the predominating organisms but a few organisms were found which were not identified. No anaerobic cultures were taken.

As early as 24 hours after the introduction of pancreatic juice into the gall bladder distinct changes could be noted in all of the coats of the gall bladder as found in dog 8. The mucosa showed evidence of beginning lymphoid hyperplasia and inflammatory cells could be seen in the stroma. Leucocytes were found in the muscular layer and the serosa was much thickened, being oedematous and extensively infiltrated by leucocytes (Fig 13). Very soon the mucosa became hyperplastic with occasional evidence of some local necrosis and usually by the fifth day the folds were more numerous and tortuous with distinct lymphoid hyperplasia. All types of inflammatory cells could be found in the stroma ranging from lymphocytes, plasma cells to eosinophiles and polymorphonuclear leucocytes (Figs 14 and 15). The infiltration was not confined to the mucosa as the muscular and serous coats were also thickened by oedema and inflammatory cell infiltration (Fig 16). In some instances the lymphoid hyperplasia of the mucosa was very extensive as seen in dog 62 which was killed 33 days after a choledochal pancreatic intubation (Fig 17). In this specimen the lymphoid changes were the most obvious but the stroma of the mucosa was extensively infiltrated by leucocytes as well. There were cases in which the changes were less pronounced as in dog 61 which was killed 21 days after a choledochal pancreatic intubation. The mucosal hypertrophy and hyperplasia were

less marked but there was extensive infiltration by plasma cells and eosinophiles. The blood vessels were enlarged and more numerous (Fig 18).

The protocols of three animals may be of interest.

Dog 21 Twenty cubic centimeters of pancreatic juice was injected into the gall bladder through a needle and the gall bladder was removed on the sixty seventh day. There were a few adhesions about the fudus of the gall bladder. The gall bladder was moderately distended, the vessels of the serosa were enlarged and the gall bladder was an opaque slate gray color. The contents were a reddish brown thick liquid containing an excess of mucoid material with a grayish white flocculent material. The wall was at least three times the normal thickness. The mucosa was deep reddish brown and velvety with numerous small grayish white plaques. Microscopical examination showed the mucosa to be hypertrophic and hyperplastic with lymphoid hyperplasia and extensive inflammatory cell infiltration. The muscular and serous coats were thickened by oedema and extensive inflammatory cell infiltration. There was an increase in the number and size of the blood vessels (Figs 19 and 20).

Dog 43 The animal was killed 175 days after a choledochal pancreatic intubation, the tubes being in place for 38 days. There were a few adhesions between the duodenum, liver, gall bladder and the abdominal wall. The gall bladder was bluish in color and the ducts were about twice the normal size. The wall of the gall bladder was but slightly thickened and the mucosa contained many small white patches about 1 millimeter in diameter. The contents were dark yellow with no deposit. The ducts were patent. Aerobic cultures showed few organisms: a short bacillus and a large coccus. The microscopic examination showed numerous cysts in the mucosa and the stroma was extensively infiltrated by eosinophiles and other inflammatory cells (Fig 21). The secretory epithelium seemed atrophic and granular, the cells taking the stain poorly. The muscular and serous coats were normal except for some inflammatory cell infiltration.

Dog 35 This animal was killed 187 days after a choledochal pancreatic intubation, the tubes being in place for 9 days. The animal was not in good condition at the time of the conclusion of the experiment. There were a few adhesions between the liver, gall bladder and the duodenum. The gall bladder was enlarged, the wall being gray in color. The ducts were dilated but there was no obstruction present. The contents of the gall bladder were dark yellow and contained a thick sediment. The mucosa was velvety. On microscopic examination the mucosa was found about three times the normal thickness showing hypertrophy and hyperplasia with many retention cysts (Fig 22). The stroma was extensively infiltrated by all types of inflammatory cells, chiefly

eosinophiles. The changes in the muscular and serous coats were minimal.

DEDUCTIONS

It will be noted that the changes in the wall of the gall bladder have a degree of similarity whether the pancreatic juice was introduced directly into the gall bladder through a needle injected into the cystic or common ducts with a needle or continuously introduced into the common duct by means of a special preparation—choleodocho pancreatic intubation. It would seem that the sudden introduction of a relatively large amount of pancreatic juice—20 cubic centimeters is more likely to produce extensive changes than when smaller amounts were injected or when a choleodocho pancreatic intubation was used.

A study of the microscopical changes in the various gall bladders would lead one to believe that under some conditions the pancreatic juice brought about a prompt destructive action of the wall of the gall bladder as represented by a non-inflammatory necrosis with edema. The question has been raised as to whether the destruction of the gall bladder wall was in every instance a true necrosis or whether it might have been a postmortem autolysis in those cases in which the animal died and was autopsied some hours later. The findings would indicate that in some instances the changes were partially if not entirely a postmortem affair but since similar changes were found in animals which were killed or in which an autopsy was done immediately after death there can be no question but that the process in many cases was a true necrosis and was associated with the introduction of pancreatic juice. Moreover in autolysis there is no increase in the thickness of the wall of the gall bladder whereas in some of our specimens there was a marked thickening as seen in Figure 7. At other times only partial necrosis took place with ulceration of the mucosa with at times rather marked changes in the muscular layer and thickening of the serosa. The changes in the muscular and serous coats appeared to be a reactionary response of the tissues to the destructive agent. Inflammatory cells were called forth, edema was present and in every way the process looked like a

typical inflammatory reaction. This reaction might have been caused by the invading bacteria which were present in all cases in which cultures were taken but since it has been proved that in dogs in 70 per cent of cases the mucosa of the gall bladder contains bacteria in 30 per cent the bile contains colon bacilli and staphylococci and as Dragstedt has recently shown the pancreas in 90 per cent yields positive cultures there must be secondary factors which afford the organisms suitable conditions to produce pathological changes in the structures. We believe that one factor is the pancreatic juice which on entering the gall bladder so devitalized the wall that the organisms, especially the anaerobes, had the necessary environment for secondary invasion.

In some instances the process was typically a reactionary or inflammatory response as evidence of necrosis was either absent or present in a minor degree. We do not believe that stasis alone will account for these changes since they were found in cases in which stasis was not present; moreover the changes took place much earlier than they appear in stasis. In those animals in which a T tube was placed in the common duct and allowed to remain in place for from 14 to 21 days the changes found in the wall of the gall bladder were insignificant.

The late changes in those cases in which a choleodocho pancreatic intubation had been done and the animals allowed to live for 175 days or longer are more difficult to explain. The common duct in each instance was patent and allowed fluid material to flow freely. In one case, dog 43, there was a scanty bacterial growth on aerobic culture from the contents of the gall bladder. In dog 21 the pancreatic juice was injected into the gall bladder and there was no mechanical interference with the ducts. The pathological changes in the latter case were so like those in the other two that we feel that the etiological process must be the same and is associated with the pancreatic juice introduced.

Another problem to arise was whether pancreatic juice can attack normal tissues of the gastrointestinal tract. From experimental work done on the cause of pancreatic necrosis

it must be concluded that such a process can take place if the pancreatic juice is activated unknown factors contributing Calzavara believed that bile would activate the pancreatic juice and by injecting bile into the pancreas brought about necrosis Nordmann after ligating the ampulla noted a distention of the pancreatic ducts which were filled with bile but no necrosis, but after the injection of cultures of dog's faeces into the gall bladder a prompt necrosis ensued Dragstedt has recently shown that the decapsulated pancreas can be implanted into a window of the duodenum and no necrosis of the pancreas takes place but when the pancreas is implanted into a window of the gall bladder the animal promptly develops pancreatic necrosis He has also shown that 100 cubic centimeters of pancreatic juice which have been passed through a Berkefeld filter can be introduced into the peritoneal cavity of a dog and cause no disturbance or fat necrosis but if the juice is not passed through a Berkefeld filter it requires 50 cubic centimeters or less to produce death From these observations it would seem logical to conclude that bile and bacterial contamination have an activating effect upon the pancreatic juice Since the gall bladder is an offshoot from the intestinal tract embryologically it is possible that there may be present in some instances glands which secrete enterokinase which may activate any pancreatic juice which finds its way into the gall bladder and thus explain the phenomenon

A second factor the alkalinity of the pancreatic juice must also be considered Ivy in attempting to study the absorptive power of the gall bladder introduced 15 cubic centimeters of one tenth normal sodium bicarbonate solution into the gall bladder Within 24 hours he noted a violent reaction in the mucosa Pancreatic juice has an alkalinity of about one tenth normal sodium bicarbonate while normal gall bladder bile is slightly acid and liver bile has an alkalinity approximately that of the pancreatic juice It is therefore possible that the introduction of an alkaline substance into the gall bladder may have been responsible for some of the changes noted in our experiments however it is difficult to explain why any unusual reaction should be manifested

in a choledochal pancreatic preparation because the pancreatic juice is mixed with common duct bile which has an equal alkalinity under ordinary circumstances

After a critical survey of all the evidence submitted it is reasonable to postulate that the process can be accounted for on the basis of complete or incomplete activation of small or large amounts of pancreatic juice in greater or lesser dilutions of bile in contact for short or long periods of time any anatomical or physiological variations modifying the process sufficient time and concentration being necessary for necrosis Deviations no doubt accounted for the varying degrees of pathological changes found in our experiments In the late chronic condition the mechanism can be explained on the basis that the pancreatic juice partially devitalized the structures of the wall of the gall bladder and secondary bacterial invasion took place This acute cholecystic condition interfered with the functions of the gall bladder especially the motility due to organic changes in the muscular and nervous structures leading to stasis which then formed the basis for the chronic cholecystitis

In reviewing the results and interpretations of these experiments it is interesting to note the observations of Blad Schoenbauer and Westphal Blad in 1918 and Schoenbauer in 1924 working on the dog and rooster demonstrated results similar to ours Their experiments were constructed with the idea of determining the cause of non perforative biliary peritonitis and for that reason introduced into the gall bladder duodenal juice to which was added cultures of streptococci and colon bacilli The cystic duct was ligated at the time of the injection The secondary elements introduced confused the problem so far as evaluating the result obtained from pancreatic juice coming in contact with the gall bladder The experiments of Westphal are extremely interesting since he introduced human duodenal juice which had been assayed as to trypsin and amylase content and passed through a Berkefeld filter thus insuring the absence of bacteria In the dog the introduction was made by opening the duodenum and cannulating the common duct through the ampulla the juice being introduced into the

gall bladder without trauma to the ducts or gall bladder. He observed in 2 dogs 4 to 5 minutes after the introduction of duodenal juice that the gall bladder showed evidence of distinct gross changes. In one of his dogs which died 10 hours after the transduodenal injection of 8 cubic centimeters of duodenal juice the gall bladder was completely necrotic. He also reported two roosters which died 4 and 5 minutes after the direct injection of duodenal juice into the gall bladder in each case the gall bladder had undergone complete necrosis. Westphal's experiments covered 42 animals and in every way the results compare favorably with the ones we have reported. The fact that he used sterile duodenal juice does not obviate the fact that a secondary infection most likely took place as was present in our cases since Andrews has shown that when the cystic duct is ligated in the dog there is a prompt invasion of the liver side of the gall bladder wall by anaerobes of the Welch bacillus type nevertheless Westphal reports one case in which the removed pathological gall bladder was sterile by culture although he does not state whether anaerobic cultures were taken or not.

In the human in a variable percentage of cases anatomical conditions are such as to form a continuous pathway between the pancreatic and biliary apparatus. Mann and Giordano placed it at 3.5 per cent while Cameron and Noble put it at 65 per cent and Westphal at 84 per cent. Since the secretory pressure of the pancreas is greater than that of the liver any obstruction at the sphincter of Oddi may allow the pancreatic juice to pass over into the common duct in case a continuous pathway is present and from there ascend to the gall bladder as shown in our experiments.

The role that spasm of the sphincter of Oddi or stasis plays in the process deserves consideration especially so since it is known that during the excessive vomiting of pregnancy reverse duodenal peristalsis occurs and possibly a spasm of the sphincter. In a variable number of cases the sphincter spasm may permit the passage of pancreatic juice into the common duct by virtue of a continuous pathway between the biliary and pan-

creatic ducts thus allowing pancreatic juice to enter the gall bladder. This theory may readily explain the common occurrence of gall bladder disease in the pregnant woman. Bundschuh described a case in which a small stone was found impacted in the ampulla the patient dying of a non perforative biliary peritonitis. The gall bladder was oedematous and completely necrotic with no sign of inflammation the gall bladder contents and the peritoneal fluid containing pancreatic ferments. Similar cases are reported by Puppenher Ruso and Clairmont and Haberer. Westphal attempts to explain the formation of gall stones on the theory that the pancreatic juice enters the gall bladder producing destruction of part or all of the wall of the gall bladder. In case only portions of the epithelium become necrotic there is a change in the colloidal chemistry in the gall bladder and the dead epithelium then forms the nuclei for stone formation.

It is a fact that all cases of gall bladder disease cannot be accounted for on the basis of a reflux of pancreatic juice yet it does seem reasonable to believe that in some instances such an etiological factor must be taken into consideration.

SUMMARY

1 In the dog when pancreatic juice conveyed into the terminal end of the common duct it can find its way into the gall bladder.

In all cases in which pancreatic juice was introduced into the gall bladder of the dog there followed unmistakable pathological changes in the wall of the gall bladder.

3 It has been shown that in the dog if pancreatic juice has been introduced into the common duct for a short period of time there follows a typical pathological picture of chronic cholecystitis which is definitely present 186 days later.

4 By analogy it is reasoned that in the human due to a continuous pathway between the pancreatic and bile ducts in a variable percentage of cases it is possible for pancreatic juice to enter the gall bladder and produce pathological changes.

I wish to express my appreciation to Dr. H. A. Bryant and Dr. J. E. Wilson for their valuable criticisms and suggestions.

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THE INCIDENCE OF GALL STONES AND GALL-BLADDER DISEASE

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F m th P th logisch A tomisch I t t des Krankenhaus es d Städte u e Austria-V enia d Pr fesso J E dh m

WITH the purpose of ascertaining the incidence of gall stones and diseases of the gall bladder in the average run of the population the gall bladder and bile passages from 1 000 routine postmortem examinations between January and July 1927 were studied The material was prepared in the following manner the stomach duodenum and liver were excised as one specimen and a longitudinal incision was made along the lesser curvature of the stomach and dorsal aspect of the duodenum Through this exposure the papilla of Vater could be examined in an undisturbed state The gall bladder itself was opened by a longitudinal incision and any abnormal contents were set aside for later consideration The common and hepatic ducts were opened and measured the cystic duct probed and opened Two hundred specimens were selected for histological study All findings normal or abnormal were recorded

The study includes subjects between 11 and 94 years of age The sex distribution is shown in Table I It is to be noted that 77.9 per cent of the subjects are over 40 years of age and

87.1 per cent over 30 years Females are slightly in excess of males

GALL STONES

Investigation of the recent literature shows that few similar studies have been made on consecutive routine necropsies In textbooks of surgery and pathology percentages of cases of gall bladder diseases and stones have been noted Naunyn found 1 case in 30 Hektoen and Riesman found calculi in 25 per cent of all cadavers at autopsy after the sixteenth year In 17 402 necropsies in 10 years Hesse found 378 cases or 2.17 per cent of gall stones From 19 European and American pathological reports including 80 802 necropsies he found 4 848 or about 6 per cent of gall stone cases Graham Cole Copher and Moore in their textbook on the gall bladder noted that 20 to 25 per cent of all adults have gall stones and probably an equal number have cholecystitis without stones which leads to the conclusion that 40 per cent of our adult population have disorders of the biliary system Mentzer (16) in 633 consecutive necropsies at the Mayo Clinic found that 21.67 per cent of the adults

TABLE I—AGE AND SEX DISTRIBUTION OF CASES

| Age in year | Males | Females | Total |
|-------------|-------|---------|-------|
| 1 to 2 | | 8 | 38 |
| 2 to 30 | 36 | 55 | 9 |
| 3 to 40 | 49 | 43 | 9 |
| 4 to 5 | 67 | 53 | 12 |
| 5 to 60 | 77 | 67 | 144 |
| 6 to 70 | 10 | 147 | 25 |
| 7 to 8 | 7 | 3 | |
| 8 to | 9 | 37 | 56 |
| Total | 40 | 550 | 600 |

had gall stones and Hansen found that stones were present in the gall bladders of 4 per cent of 302 adult cadavers

An examination of Table II shows enough difference between some aspects of the figure obtained in our study and those reported in the literature to warrant a report of our findings. The total number of cases with stones of all kinds was 35 (3.5 per cent).

The stones were divided into groups according to a recent classification of Aschoff and Baumeister:

1. Inflammatory or common gall bladder stones
2. Pure bilirubincalcium stones
3. Pure cholesterol stones
4. Combination stones
 - (a) Combination bilirubincalcium
 - (b) Combination cholesterol
5. Calcium carbonate stones

The *inflammatory or common gall bladder stone* is essentially a cholesterol stone with some bile pigment. It has various colors, is practically always faceted and almost never larger than 2.0 centimeters in diameter. There is no gross crystalline structure but a laminated structure comparable to the cross section of a tree trunk is present. Very frequently the stones fracture, the exact cause of which is unknown and new lamellae can be laid down around the fragments. By studying the cross section of the stone under the microscope its life history can be determined and some authors believe that each new lamina denotes an attack of inflammation of the gall bladder. It is not within the scope of this paper to explain the detail of the structure of inflammatory stone and the inferences which can be drawn therefrom. Suffice it to say that some highly interesting pictures are presented in the cross section of this type of stone. In this study

25, 1 per cent of all the cases had inflammatory stones, 13 per cent of all the stones found were inflammatory.

Pure bilirubincalcium stones alone are considered in the class of non-inflammatory or metabolic stones because they are almost never associated with cholecystitis. Their physical characteristics make them unmistakable. Varying in size from a grain of sand to a pea, they consist chiefly of bilirubincalcium and mucus. There are hard and soft varieties depending upon the admixture of mucus and they have the appearance of minute black burrs. Two and nine tenths per cent of all the cases had bilirubincalcium stones. Thus 9 per cent of all the stones were made up chiefly of bilirubincalcium.

The *pure cholesterol stone* contains about 93 per cent cholesterol. It is usually water colored but may be stained a faint yellow from the bile. It is often egg shaped with a long and a short diameter and may be smaller on one end than the other. On longitudinal section the radial crystalline structure is well demonstrated. This stone is considered metabolic in origin. Twenty-two such stones existed alone in our cases and comprised 7 per cent of the stone cases.

The two metabolic stones described above can offer a mechanical obstruction of the gall bladder at its neck, give rise to a stasis inflammation with the formation of the so-called *combination stone*. The metabolic stone is the nucleus and is encased in one or more layers of inflammatory deposit which may show the same number of layers as any associated inflammatory stones present. The associated inflammatory stones are counted with the other inflammatory stones but are deducted from total stone cases. They comprise 9 per cent of the total stone cases. Combination stones with bilirubincalcium as a nucleus numbered 15 or 4.6 per cent of the stone cases. Combination cholesterol stones numbered 15 or 15.4 per cent of the stone cases.

The *calcium carbonate stone* is a rare form seen only on a few occasions. It is usually pure white or stained yellow with bile and has the form of a mulberry.

Graham et al. noted that cholelithiasis is found more commonly in women than in men.

the ratio being two to five times more frequent in the former. Hesse in his large series of cases puts the ratio as one male to seven females. In our cases there were 207 women (37.8 per cent of the females) and 118 men (26.2 per cent of this group) which is only 10 per cent more women than men.

Graham also noted that the incidence of gall stones increases as age advances with the majority of the patients over 30 years of age and less than 1 per cent under 20 years of age. In our series there were no cases under 20 years of age which was not remarkable as there are only 38 cases in this group. Mosher in a study of 1,655 necropsy records at the Johns Hopkins Hospital found that 8 per cent of the patients dying in the fourth decade had gall stones. In the fifth and sixth decades there were 13 per cent. The most frequent age in Hesse's series was from 60 to 70 years. In our series 25 per cent of males and females were affected in the fifth decade with a rapid rise with each decade until 50 per cent of both males and females over 70 were affected.

GALL BLADDER

Graham suggests the word *cholecystopathy* as an all inclusive term for diseases of the gall bladder in order to retain the word *cholecystitis* for the true inflammation and allow this new term to include all pathological anatomical as well as functional disturbances. *Cholecystopathy* will be used in this sense here.

With regard to the incidence of *cholecystopathy*, Mentzer (15) found in 612 routine post mortem examinations evidence of *cholecystic* disease in 66 per cent of the cases. Our percentage comes out slightly below this figure, namely 59.6 per cent. Graham states that gall bladder disease is two and one half times as frequent in females as in males. In Blacklock's series of 888 cases from the Johns Hopkins Hospital the ratio of females to males was two to one.

In our cases the males were affected in 265 instances or 58.4 per cent of the group and females in 331 cases or 60.2 per cent of the female group. It can be seen again that males and females were nearly equally affected in this series.

In the literature it is generally held that gall bladder disease is most prevalent after the fourth decade although recent studies show it to be more frequent than one would expect under this age. Table III shows no continuous increase in incidence with the advance of the decades but the general trend is upward. Thus the lowest percentage of cases with *cholecystopathy* is 20 per cent in the males between 11 and 20 years of age. The highest percentage is 77.6 in males between 71 and 80 years. After the fourth decade never less than half the individuals are free from macroscopic signs of a pathological gall bladder and under this age the percentages do not run very far below this figure. The microscopic sections were made in this series to confirm suspicious gross findings and every case was not sectioned otherwise there would undoubtedly have been a higher percentage thrown over into the pathological groups. In the absence of stones if the serosa was glistening the gall bladder wall not thickened, no evidence of scar formation in the mucosa the gall bladder was considered normal.

In 848 cases of *cholecystopathy* in the Barnes Hospital Graham found 7.6 per cent to be acute *cholecystitis*. Acute *cholecystitis* occurred in 48 cases or 8.3 per cent of our 596 pathological cases and was severe enough to be classified as *empyema* in 38 cases and *phlegmon* in 14 instances. In all of the cases in which the inflammation was severe stones were present and in some instances the stones had caused actual ulceration of the wall of the gall bladder (23 cases). However even with the most extensive involvement of the gall bladder the process can heal and in some cases is aided in the healing process by the establishment of drainage through a fistula (22 cases). There were 63 instances in which the inflammation had progressed so far that the gall bladder was entirely destroyed by the process and in the event of healing left a contracted mass of scar tissue.

Signs of chronic and healed *cholecystitis* were found in 300 cases which is 30 per cent of the total cases and 50.2 per cent of the pathological ones. In some instances the gall bladder was the victim of such a marked sclerosing process that it presented itself as a shrunken

mass closely adherent to the stones. It is interesting to note at this point that many times when this occurred the stones would take up their position at the neck and in the fundus and give the appearance of an hour glass (17 cases). Another sequel to healed inflammation is the formation of *diverticula* in the wall of the gall bladder (55 cases) in 31 of which the *diverticula* were very small and contained black concretions.

Most of the cases with *fistula* were in the healed class for it was by the establishment of drainage in this manner that the infected gall bladder was healed. There was one exception to this namely when the gall bladder had established a communication with the stomach. Then extensive stone formation and inflammation supervened and all the patients died of their gall bladder disease. This appears to be an argument against cholecystogastrotomy. In this series only the transverse colon, duodenum and stomach had fistulous communication with the gall bladder.

Acute pericholecystitis was found in 30 instances with a walled off abscess in 14 of these cases. Only a minority of the cases (18 out of 48) with acute cholecystitis showed gross evidence of the inflammation having reached the serosa and in 12 instances the acute pericholecystitis was limited to the external layer. Under the latter circumstances however other intra abdominal suppurative lesions could be found. The construction of the wall of the gall bladder seems to be such that inflammation does not work its way through readily. This is also borne out by the fact that in a large group of chronic and healed pericholecystitis with or without pericholecystic adhesions microscopic as well as macroscopic evidence of inflammation in the mucosa and adjacent layers was lacking. Two cases in which large acid fast tubercles were found in the subserosa showed no involvement of the other layers of the gall bladder.

Chronic and healed pericholecystitis was by far the most common pathological finding in this study. Chiray Pavel and Georges found 489 cases of pericholecystic adhesions in 1000 selected cases with gall bladder disease. Their cases occurred twice as frequently without stones as with stones. Of the cases with chole-

cystopathy 474 individuals or 82.2 per cent comprised this group and in a large number of cases the condition existed alone. Only bladders with definite scar formation in the serosa were considered in this group and cases with a thickened indurated wall were classified under chronic cholecystitis. When the serosa remained glistening and smooth any strands were considered to be of an anatomical nature.

In 237 cases (39 per cent of all the pathological cases) scars and other signs of inflammation were found in the gall bladder in which there were no stones present. Most of these cases however came from those grouped under chronic pericholecystitis. In other cases with *fistula* no stones were found and had undoubtedly been emptied into the intestinal tract through the artificial opening. Thus it is seen that even the 32.5 per cent of gall stone cases as mentioned under the previous heading is a low figure. On the contrary however 66 cases showed the inflammatory or common gall stone without signs of inflammation in the vesicle. Only 21 instances with signs of recent or old inflammation of the gall bladder were found when the metabolic or pure cholesterol and bilirubinocalcium stones were present.

Next will be considered a condition which many authors feel is a pathological state of the gall bladder namely *cholesterosis*. Since this is not a definitely proved pathological condition it is given separate treatment (Table IV). It is not an inflammatory process but may be associated with inflammation. The mucosa contains an abundance of lipid material which is easily seen as yellow granules against the red or green background of the mucosa. The condition is poorly understood at the present time but Graham states that it may cause symptoms analogous to chronic cholecystitis is relieved by operation and should therefore be considered as an example of cholecystopathy. Lucene and Moulouguet found strawberry gall bladder in 15 cases out of 84 and referred to MacCarty who found 18 out of every 100 of 5000 cases operated upon for cholecystopathy. Cholesterosis appeared in 368 of our cases was more prevalent in the earlier than in the later decades and was associated with other conditions in 203 cases. The majority of the associated pathological states

TABLE II—TOTAL GALL STONES WITH AGE AND SEX DISTRIBUTION

| | N _f | $\frac{e}{f}$ $\frac{t}{e}$ | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | S _t |
|--|----------------|--------------------------------|------|---|---|---|-----|-----|---|-----|-----|-----|-----|----|-----|----|-----|----|----|-----|----------------|
| l f n m t y o o m m g n b l d d t e | 37 | 73 | | | | | 7 | | 5 | 8 | | 9 | 6 | 7 | 45 | 3 | 53 | 8 | 6 | | |
| P b l r b l m s t e | 9 | 9 | | | | | | | 3 | | 1 | | 6 | 8 | 3 | 3 | | | | 1 | |
| P h l e s t l t | | 7 | | | | | 1 | | | | | 3 | | 5 | 3 | 5 | | | | 1 | |
| C m b t b l b l m t | 5 | 4 6 | | | | | | | 3 | | 1 | 0 | 4 | | 2 | | | | | 0 | |
| C m b t c h i t l t | 50 | 5 4 | | | | | 1 | | | 1 | | 9 | | 4 | 4 | | | | | | |
| Numb st | 3 5 | 8 | 7 | — | — | — | 8 | 3 | 5 | 6 | 3 | | 5 | 10 | 7 | 39 | 66 | | | | |
| P t g f t a s e a | — | 36 3 | 63 7 | — | — | — | 2 7 | 0 | 5 | 5 | 4 | 3 3 | 7 7 | | | | | | 3 | 6 | |
| P t g f t t l | 3 5 | 6 | 37 8 | — | — | — | 4 5 | 6 1 | | 4 | 5 | 4 | 37 | 35 | 48 | 54 | 5 | 53 | 51 | | |
| L o t t o a b i l y p a s g | N | e ^r | | | | | | | | | | | | | | | | | | | |
| S t l y t d t | 38 | 48 7 | | | | | | | | | | | | 6 | 6 | 3 | 8 | | | 5 | |
| S t e i n h e p t e d t a | | 8 | | | | | 0 | | | | | | | 3 | | 3 | 9 | 3 | | | |
| S t n m m b l d t | 4 | 3 7 | | | | 0 | | | | | | 1 | 3 | 3 | | 3 | | | | | |
| S t e s t h p p u l l a V t | 47 | 60 | | | | 0 | | | | | 2 | | 4 | 0 | 6 | 6 | | | | | |
| N m b s w t h t e s d t | 78 | 3 | 48 | — | — | — | | 1 | 4 | 4 | | 5 | | | | 9 | 9 | 4 | 7 | | |
| P t a g o f t o s e w i t h t e s d t | 4 | 5 4 | 3 | — | — | — | | | 5 | 3 | 3 | | 3 | 15 | 7 | 3 | 8 | 4 | | 35 | |
| P c t g f t o t a l w i t h t e d t | 7 8 | 6 6 | 8 7 | — | — | — | 8 | | 3 | 5 0 | 7 5 | 6 7 | 5 | | 7 5 | 3 | 4 6 | | | 8 0 | |

was chronic pericholecystitis and papilloma-
tosis while in a few instances a mild chronic
cholecystitis was present. Common or inflam-
matory gall stones were present in 17 instances
and pure metabolic stones in 13 instances of
these cases without other demonstrable pa-
thology. In 165 cases the condition existed alone
and if it is to be considered pathological these
cases are to be added to our total of 596 in-
stances of known cholecystopathy. This makes
a grand total of 761 cases of cholecystopathy
or 76.1 per cent of unselected individuals.

Tumors of the gall bladder are divided into benign and malignant. Of the benign tumors only *papilloma* was found in this series and that in 78 instances. Hypertrophy of the mucosa was not considered under this heading. The growths had to be well developed with a body and pedicle to be classified as such. The papillomata usually contained lipid material

Deaver and Bortz found carcinoma of the gall bladder in 13 instances (1.4 per cent) of a selected series of 903 cases with gall bladder disease. In 943 autopsies Lotzin found 27 instances of primary carcinoma of the biliary

passages or practically 1 per cent. *Primary carcinoma* of the gall bladder and ducts occurred in 26 instances (2.6 per cent of the total cases) and in 2 of these cases the primary tumor was located in the bile ducts. Carcinomatous metastases from other sources though frequent had no apparent pathological effect on the gall bladder. When the gall bladder was the primary site there were practically always metastases in the ducts (19 of the 26 cases) especially the cystic and common bile ducts (Table V). This was a more frequent site for metastasis than the liver itself. Gall bladder carcinoma rarely metastasizes to sites other than those mentioned. Four of the cases with the primary lesion in the vesicle showed no gall stones but in two of these however fistulous communication with the duodenum and transverse colon made it appear that the stones had departed by this route. In the third case without stones the diagnosis was first made under the microscope as the gall bladder had a normal gross appearance except at the site of the tumor in the fundus, where the gall bladder wall was

TABLE III—TOTAL CHOLECYSTOPATHY WITH AGE AND SEX DISTRIBUTION

[illegible]

folded on itself and slightly thickened. Iotzin believes that carcinoma of the gall bladder and stone formation are independent of each other and two of our cases present confirmatory evidence to this view. The first case with out stones is of such interest that it merits a detailed report.

A housewife 77 years of age died on March 7, 1915 with a diagnosis of carcinoma of the gall bladder metastases to the liver and cholelithiasis. The necropsy failed to reveal the stones but the gall bladder was transformed into a carcinomatous mass which had become adherent to the transverse colon with the establishment of a fistula. (The stones may have been emptied through the colon.) The cystic and hepatic ducts were completely occluded by metastatic material that there was no bile in the gall bladder. Above the metastases in the hepatic ducts the latter were enormously dilated and contained water colored bile. Metastases were present in the liver. Since the patient died 15 days after she had had

continuous stomach trouble and even before her tenth year attacks of true biliary colic had occurred. Since August 1926 the patient had had three intermittent attacks of jaundice.

Before leaving the gall bladder mention is made of the occurrence of *peritoneal bands* (Table IV). They were present in 73 instances and are not to be confused with adhesions formed following inflammation in the gall bladder region. The latter condition is practically always associated with localized thickening of the liver capsule while in the former the peritoneum retains its glistening appearance.

BILIARY DUCTS

Disease of the biliary ducts very rarely exists in the absence of cholecystopathy. Gall stones, tumors and pathological conditions at the hilum of the liver are the chief causative

TABLE IV—CHOLESTEROSIS OR STRAWBERRY GALL BLADDER PERITONEAL BAND OF GALL BLADDER

| | N | % | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F |
|-------------------------------|-----|------|------|------|---|---|------|-----|---|---|---|----|-----|------|----|------|----|----|-----|-----|
| | | | | | | | | | | | | | | | | | | | | |
| Ch l t with b l top thy | 3 | 55 | | | | | 2 | 6 | 7 | 9 | 3 | 4 | | 6 | 4 | 6 | 34 | 19 | 9 | 5 |
| Ch l t with t h l c y t p thy | 6 | 44.9 | | | 5 | 9 | 6 | 6 | 6 | 9 | 8 | 9 | 5 | | 8 | 5 | 7 | 4 | 4 | |
| T t l with b l est | 368 | | 6 | 7 | 6 | | | 3 | 5 | 7 | | | 3 | 6 | 44 | 49 | 6 | 43 | 5 | 7 |
| P tag of t t l | 368 | | 35.8 | 37.7 | 3 | 6 | 33.3 | 4.8 | 3 | 6 | 3 | 39 | 6.4 | 38.8 | 4 | 33.3 | 36 | 33 | 6.3 | 8.9 |
| P t l b ds f g l l b l d d | 73 | | | | | | 3 | 7 | | 1 | 4 | 6 | | 5 | 7 | 5 | | 5 | | 3 |

factors in disturbances of the biliary ducts. The last item consists mainly of tuberculous glands carcinomatous metastases and non specific inflammation at the hilum of the liver. Only in a minority of these instances was the function of the ducts impaired by external pressure and rarely was there a complete blocking of the ducts but in most cases pathological conditions at the hilum of the liver left the biliary passages unaffected.

The importance of gall stones in the biliary ducts has been repeatedly emphasized in the literature. Wilkie found 47 cases of stones in the bile ducts in 257 operated cases of cholelithiasis (18 per cent). Clute noted an increase from 8.4 per cent to 17.9 per cent of common duct stone findings in a large series of cases operated upon for cholecystopathy in which there was a corresponding increase in explorations of the common duct. These are two representative illustrations from the literature of a selected series. Courvoisier has shown the frequency of stones in the bile ducts in figures given from postmortem records of the Basle Pathological Institute. In his series 3.9 per cent of all cases of gall stones and 0.4 per cent of 520 necropsies had stones in the bile ducts.

In this study 78 of the 35 cases with gall stones had stones located in the biliary passages (Table II). This is 24 per cent of the stone cases and 7.8 per cent of the total cases. One could conclude from this that every patient operated upon for cholelithiasis has one chance in four of having additional stones in the bile ducts. In this series there were 5 instances of gall stones in the ducts after a stone filled gall bladder had been removed and in

one of these the common duct was half filled with stones even after an exploration of this structure at the time of operation. The liver is the source of some of these stones.

It is to be noted that the percentages show no upward or downward trend with the advance of the decades so that the age of an individual with cholelithiasis does not affect his 24 per cent chance of having stones in the bile ducts. A male with cholelithiasis has as much chance of having a stone in the duct as a female. The cystic duct and the papilla of Vater seem to be the most frequent extra vesicular locations of stones the former harboring 48.7 per cent of these stones and the papilla 60.2 per cent.

The sequelæ of stones in the ducts are dilatation of the latter and laceration of the papilla of Vater. There were 210 cases with definite dilatation of the biliary ducts in which 120 had stones in the gall bladder and 35 showed stones in both locations (Table V). Nine of the stones were of the metabolic variety. The remainder of the 210 cases showed cholecystopathy but no stones. Some authors feel that definitely dilated ducts a lacerated papilla of Vater and a gall bladder with signs of healed inflammation are evidence of pre-existent stones and there is no reason to believe that this is not the case. Under these circumstances many more than 32.5 per cent of individuals would have gall stones at some time in their lives. However dilatation of the ducts and laceration of the papilla of Vater occur in the absence of cholecystopathy and in the case of the former (Luettkens) appears to be associated with general senile loss of tissue elasticity (55 cases). In 60 instances the

TABLE V--DISEASES OF BILIARY DUCTS--AGE AND SEX DISTRIBUTION

[illegible]

presence of stones in the ducts caused an actual inflammation of these structures although in 8 cases the presence of stones left the ducts entirely unaffected. *Ductulae* and *fistulae* occurred in a small number of instances and were associated with stones.

Of the benign tumors of the bile ducts only the papilloma was found and this in 5 instances. Primary carcinoma which is not an infrequent finding in the literature (Tulde) was present in 2 cases. In both cases the ducts were completely occluded at the site of the tumor. One was situated in the left hepatic duct and caused a complete atrophy of that region of the liver drained by the duct. The other primary lesion was located at the lower end of the common duct and had involved the wall of the duodenum and perforated the

latter at one point. Common gall stones were present in the gall bladder which showed no other signs of inflammation and the ducts proximal to the lesion were enormously dilated. There were 19 instances of *metastatic carcinoma* from a primary gall bladder lesion and in only 3 of these cases was there interference with the function of the ducts. One caused complete the other partial obstruction and in the third the metastasis had caused a perforation of the duct.

SUMMARY

In the study of the material from 1 000 routine necropsies at the City Hospital in Vienna the following facts were brought to light

1 In the series there were 450 males and 550 females. Eighty seven and one tenth per

cent of the individuals were over 30 and 77.9 per cent over 40 years of age

2 Gall stones were present in 32.5 per cent of the cases. These were present in 37.8 per cent of the females and 26.2 per cent of the males. Twenty-five per cent of the individuals were affected after the fourth decade and 50 per cent after the seventh. Inflammatory or common gall stones made up 73 per cent of the stone cases.

3 Cholecystopathy occurred in 59.6 per cent of all cases and affected males in 58.4 per cent and females in 60.2 per cent. With the advance of the decades the case incidence increased from 20 per cent in the first age group to 77.6 per cent in the eighth decade. Chronic percholecystitis was the most frequent pathological condition (82.2 per cent) and chronic cholecystitis was next in frequency (50.2 per cent). Primary carcinoma of the biliary tract occurred in 26 instances—7 males, 19 females—in which stones were present in all but 4 cases. In 2 cases the growths were primary in the ducts.

4 Cholesterosis of the gall bladder was present in 36.8 per cent of all cases. Males were affected in 35.8 per cent and females in 37.7 per cent of the cases. This condition was very frequent in the early decades and maintained a more or less constant average throughout the age groups. If cholesterosis is to be considered a pathological condition, the general average of cases of cholecystopathy would be raised to 76.1 per cent.

5 Pathological conditions were present in the biliary tract in 41.3 per cent of all cases. Males were affected in 34.9 per cent, females in 46.5 per cent. There was an increase in incidence of disease with the advance of the decades. The most frequent finding was dilated ducts in 50.8 per cent and next frequent a lacerated papilla of Vater in 47.7 per cent of the abnormal findings.

6 Gall stones were found in the bile ducts in 78 cases, which is 24 per cent of the cases

with cholelithiasis. Males were affected in 66 per cent and females in 87 per cent of the cases. This finding was not affected by the age of an individual so that any patient with gall stones has one chance in four of having stones in the bile ducts. The most common site was at the papilla of Vater (60.2 per cent) and next frequent site the cystic duct, 48.7 per cent.

7 The figures presented in this paper are definitely higher than those found in similar studies in the literature.

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CHRONIC INFLAMMATION OF THE SALIVARY GLANDS WITH OR WITHOUT CALCULI

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THE symptoms and clinical picture of chronic inflammation of the salivary glands is sometimes not recognized by either internist or surgeon with the result that mistakes in diagnosis and treatment are often made. The disease does not necessarily have to be associated with the presence of a stone in the gland or duct and the stone if present is not always demonstrable by the roentgenogram.

We are reporting here 110 cases of non-specific inflammation of the salivary glands in 70 of which salivary calculi were present also. We have excluded from this group all cases in which tuberculosis, syphilis and actinomycosis were the etiological factors; also cases of acute and postoperative parotitis and cases in which there were malignant lesions about the mouth or face.

SYMPTOMS

Although the clinical grouping of chronic inflammatory conditions of the salivary glands usually includes the presence or absence of a stone from a clinical standpoint this makes little difference. Patients with chronic inflammation of the salivary glands usually present themselves for examination first because of exacerbation of acute infection in an old chronic inflammatory salivary gland and second because of obstruction of the duct by a small stone blocking the drainage of saliva. The most common complaint is the repeated exacerbations of acute infections rather than the symptoms of obstruction from a stone.

In all cases of salivary calculi one can express pus or mucopus from the duct and it is the acute exacerbation of this infection which is the most common symptom for which the patients present themselves. Some patients have had tonsils or wisdom teeth removed in an attempt to get rid of the repeated sub-

maxillary inflammatory condition. So called salivary colic due to the swelling of the salivary gland behind the stone accompanied by sudden severe pain in the floor of the mouth, tongue and side of the throat occurring during meals or sometimes with the mere sight of food is an occasional symptom but not the most common in this group of cases. Most of the patients have had symptoms extending over months or years the average being 4 to 5 years. 39 per cent gave a history of previous attacks. The severe attacks of pain usually described as being pathognomonic of submaxillary stone rarely occur. Only 62 per cent of our patients noticed any pain and most of them described the pain as mild. After an acute infection pus usually discharges into the mouth; this relieves the patient of the pain and swelling and he may not have another attack for months or years. A chronic inflammatory condition of the submaxillary salivary gland in the absence of calculi is usually due to a chronic condition following an acute abscess of the salivary gland. This may entirely clear up or continue to drain as a chronic productive type of infection. Of the 40 patients with chronic inflammatory salivary glands without calculi in our group 14 (35 per cent) gave a history of intermittent swelling and 7 (17 per cent) stated that the swelling was brought on at mealtime. Although pus can be expressed from the duct it usually is thin. Infection may recur in this group although between these exacerbations the gland gives little trouble other than its enlargement.

INCIDENCE

In 70 of the 110 cases salivary calculi were present and in 40 no calculi were found. Calculi of the salivary glands or ducts are considered by most observers to be very uncommon.

mon Erdman in 1920 found 300 cases in the literature and Harrison in 1926 raised the total number to 375 and added 27 cases of his own

Calculi are found most often in the submaxillary gland or duct and less often in the sublingual gland Wakeley reported the percentage of incidence according to the gland or duct involved as submaxillary 63.2 per cent, parotid 20.6 per cent and sublingual 16.2 per cent. In our series of cases there is a larger portion in the submaxillary gland—that is the submaxillary gland or duct 66 (92.9 per cent), the parotid gland or duct 3 (4.3 per cent) and the sublingual gland or duct 2 (2.8 per cent).

Although Wakeley after careful search of the literature was able to find references to only 3 cases in which the calculi were present in more than one gland or duct in the same person we noted in one case the presence of calculi in both the submaxillary and sublingual ducts and in one case both submaxillary glands were involved. The right submaxillary gland is affected almost twice as often as the left. We are unable to account for this coincidence and we did not find any reference to this observation in the literature.

The condition occurs in middle life. According to Wakeley more men are affected than women (proportion 2:1). Carter put the proportion as about 5:1. In our 70 cases of chronic inflammation of the salivary gland with stone 45 patients were males and 25 were females. In the 40 cases of chronic inflammation of the salivary glands without stone the submaxillary gland was also the most commonly affected. On the other hand the acute postoperative inflammations that are commonly seen after operations on the upper part of the abdomen are usually situated in the parotid gland rather than in the submaxillary. The distribution of our cases was submaxillary gland 32 (80 per cent), parotid gland 5 (12.5 per cent) and the sublingual gland 3 (7.5 per cent). In this group as in the cases in which calculi are present males are affected about twice as often as females. In our series of 40 cases without stone there were 27 males and 13 females; their ages were about middle life. There were only 3 cases of parotid calculi in our series; in 1 case they occurred in the gland



FIG. 1. Retouched roentgenogram. The large stone in the submaxillary duct and the multiple stones in the sublingual salivary gland may be seen.

itself and in 2 cases in Stenson's duct. In these 3 cases there was a history of long duration with intermittent swelling and slight pain. In each case a single calculus was found. Wakeley stated that multiple parotid calculi are more common than single. He also stated his belief that formation of the abscess is common around long standing calculi and that in case an abscess opens externally a fistula generally results. There were 2 cases of sublingual calculi and in 1 of these a stone was present in both submaxillary and sublingual glands (Figs. 1, 2 and 3).

ETIOLOGY

Wakeley in a study of calculi in the submaxillary region found that they were 75 per cent calcium carbonate and 10 per cent calcium phosphate. Saliva from the submaxillary salivary glands permits calcium salts to be seen more easily than does the saliva of the parotid or lingual gland due to the high percentage of solids and organic matter, the greater degree of alkalinity and the low content of carbon dioxide. Tartar usually forms about the lingual surface of the lower anterior teeth and it is probably the same factor that produces the stones in the submaxillary glands.

and ducts Roberg who investigated 47 cases of salivary calculi stated that foreign bodies and salivary calculi often are present in the duct Wakeley showed a fishbone found in a Stenson's duct with salivary calculi around it. Foreign bodies in the salivary ducts are rarely seen and probably are not factors in the production of salivary calculi. The stones may form around organic matter or bacteria in the gland substance of the duct.

PATHOLOGY

The size of salivary calculi varies from a few millimeters in diameter to 3 by 5 centimeters as reported by Garretson. Orth described a stone weighing 70 grams. Although it is rare to find more than one stone in a single gland or duct Noehren reported a case with fourteen stones in Wharton's duct and Soderlund found thirty in the submaxillary duct. In 8 of our cases stones were multiple. In 4 cases there were two or three stones in the submaxillary gland. In 3 other cases there were multiple stones in the submaxillary duct.

The pathological changes in these cases have been considered by Henke and Lubarsch. The obstruction resulting from stone in the duct causes congestion of the mucosa of the ducts with petechial hemorrhages. In case a large stone is present erosion and ulcer may result. These processes lead to the formation of granulations with resulting fibrosis and more complete obstruction. As a result of the obstruction to secretion the intralobular ducts become congested and dilated; this is followed by atrophy of the tissue of the gland. After obstruction infection results readily often forming a phlegmon in the gland and surrounding structures.

Henke and Lubarsch mentioned that stones may be extruded by the formation of a fistula which communicates with the surface of the skin. This was found in 3 of our cases. Roberg was unable to find references to salivary fistula other than those connected with Stenson's duct. Harrison reported 1 case in which a salivary fistula was connected with Wharton's duct. Only 4 cases of external fistula were noted in our entire series and all were associated with the submaxillary gland. A diagnosis of branchial sinus was made in 1

case and thyroglossal sinus in 2 cases because the opening of the sinus was close to the median line.

Henke and Lubarsch described two types of chronic inflammation of the salivary glands without stone: the chronic exudative and the chronic productive. Chronic exudative inflammation often follows acute inflammation and may be associated with it. The gross picture is that of swelling and enlargement of the gland associated with abscess. Microscopically there is lymphocytic and plasma cell infiltration associated with a lesser degree of leucocytic infiltration. The purulent material forms around granulation tissue resulting in the formation of abscess.

METHODS OF DIAGNOSIS

In the examination of a patient presenting an enlarged submaxillary gland a bimanual examination should be made. In 92 per cent of our cases in which stones were present pus could be expressed from Wharton's duct. The opening of the duct is usually red and thick and if a stone is present it can usually be felt with the forefinger. We do not believe that probing the duct is advisable as this frequently tends to stir up secondary infection by traumatizing the duct and does not aid in the diagnosis. The roentgen ray should always be used to confirm the clinical diagnosis and in cases in which the stone is lodged in the gland itself with much thickening it may be the only positive way of finding the stone. Erdman considered the roentgen ray of little value whereas Harrison found it of positive value in 75 to 85 per cent of his cases. In 80 per cent of our cases in which stones were present they were demonstrated in the roentgenogram. Hickey described improved technique for demonstrating these calculi. The patient is allowed to lie supine on the table with the head projecting over the end. A large film is placed in the mouth and held in position by closing the teeth. The roentgen rays are directed from above downward with the central ray passing through the center of the mouth.

Differential diagnosis in this group must include chronic submaxillary lymphadenitis, actinomycosis, carcinoma of mixed tumor



Fig 2 Retouched roentgenogram The rounded stone in the submaxillary salivary gland may be seen

type and specific inflammatory lesions such as syphilis and tuberculosis

TREATMENT

The treatment depends on the condition at the time the patient comes for examination. If there is an acute infection as there often is the use of hot irrigations and hot dressings is the advisable treatment until the acute condition subsides. Probing the duct or any manipulation at this time not only is not beneficial but frequently increases the cellulitis and is a very dangerous procedure. After the acute condition has subsided roentgenograms are made to exclude the presence of a stone. If a stone is present and is situated anteriorly in the gland or in the duct removal through the mouth is the treatment of choice. Removal of the stone however may not clear up the condition of the gland because of the nature of the gland and the multiple pockets of inflammation that may be present.

In 30 of our series of 70 cases of chronic inflammation of the salivary gland with stone the stone was removed from the duct. In 13 the stone was removed from the body of the gland through the mouth. In the remaining 27 on account of the situation of the stone and the amount of infection present it was



Fig 3 Retouched roentgenogram The multiple stones in the submaxillary salivary gland and one very large stone may be seen

thought best to remove the entire gland. Of the 30 cases in which the stone was removed from the duct there were 4 (13 per cent) in which there was recurrence of symptoms. In the 13 cases in which the stone was removed from the body of the gland there were 3 (23 per cent) in which there was recurrence of symptoms. In the cases in which the entire gland was removed there was no further trouble. So in 43 cases in which the stone was removed from the duct or the gland through the mouth there were 7 (16.3 per cent) in which symptoms recurred. If however there is a great deal of infection present in the gland and a long history of recurring suppuration it is useless to expect this to be entirely cleared by removal of the stone alone. It is this type of case in which removal of the entire gland is the advisable treatment.

In the group of 40 cases of chronic inflammation without stone 18 patients had received treatment before examination at the clinic. Drainage from the outside was instituted in 13, drainage through the duct the duct having been probed in 3 and a stone had been removed from the duct in 1 case. In this latter group of cases if the exacerbations are giving sufficient trouble the only treatment advisable is removal of the entire gland.

ROENTGENOGRAPHIC DIAGNOSIS OF DISEASES OF THE BREAST

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IT is not necessary to emphasize that any additional method of diagnosis in which promises increased accuracy in any field is welcome. It is not always possible to diagnose lesions of the breast with the degree of accuracy necessary for definite therapeutic decision. Of course the general dictum is—remove lump in the breast or at least explore them. Frozen section diagnosis in the hands of competent pathologists has rendered noteworthy service to the decision of what to do in many cases. In the clinical diagnosis however there still remains a margin of error which it is advisable to reduce.

Before describing the various shadows cast by normal and pathological breasts it is necessary to have a clear mental picture of both normal and pathological organs as determined by gross and microscopic studies. It is quite well established that a normal breast is a composite of certain fundamental anatomical structures in various stages of development and change due to such factors as age, adiposity, puberty, the menstrual cycle, pregnancy, menopause, pre-existing pathological lesions, etc. A brief resume is as follows. In both male and female children before puberty the breast as a rudimentary organ consists of a nipple from which a few ducts radiate fanwise. The ducts are embedded in dense connective tissue, relatively poorly nucleated and poorly vascular. At the end of the ducts are blunt blind extremities. Puberty determines the onset of sex differences which are fundamentally of degree only. The breast at puberty enlarges by hypertrophy and hyperplasia. When completed it consists of a number of lobes separated from each other by connective tissue and elastic septa coming from the anterior sheath of the pectoralis muscle. In these lobes is a supporting tissue of fat in varying amounts in a loosely constructed poorly cellular fibrous tissue with some elastica. The blind ends of the ducts in the prepubertal stage develop buds in increasing number and complexity

which are canalized further and further into the organ. Whorled around the final ends of these duct complexes is another kind of connective tissue, the so-called perilobular connective tissue. The changes of pregnancy begin as soon as conception occurs and consist of (1) ever increasing budding and hyperplasia of the ends of the ducts and (2) disappearance of the connective tissues. At the end of pregnancy the normal breast is then a mass of ducts and acini with just sufficient connective tissue for support. Naturally there is increased vascularization. When lactation is interrupted the reverse occurs: the epithelial structures disappear and the connective tissues reappear until the end result is an anatomical structure similar to that before conception occurred.

Exactly the same changes occur at each menstrual period but less in degree. Thus the breast of the woman from the ages of puberty to menopause is never quiet but suffers reciprocal growth and disappearance of epithelial and connective tissues.

Various pathological lesions are caused by failure of proper involution of both the lactating breast and the breast regressing from the menstrual stimulus. The epithelial cells disappearing by way of cloudy swelling, fatty degeneration, atolysis, etc., are removed by the lymphatics but some desquamated cells may remain in both lymphatics and ducts and obstruct them. The perilobular connective tissue as it grows may also obstruct ducts and lymphatics. This leads to damming back of material and the formation of cysts as a local or more or less diffuse process. Secondary changes such as cellular infiltrations and proliferation of connective tissue may then occur. When these changes are present as they are to some degree in nearly every breast there is this constant stimulus to further rearrangements and growths and exudations even after the menopause.

The commonest benign tumor of the breast is the periductal fibroma. (This name is used

to include such tumors as are often called adenofibroma fibro adenoma intracanalicular adenomyofibroma etc.) They are localized growths encapsulated denser than normal breast tissue contain practically no fat and show a tendency to lobulation usually into small complexes separated from each other by heavier bands of connective tissue

Cysts of the breast other than those caused by abnormal involution or those grouped under the condition known as

Schimmelbusch's disease are of inflammatory origin and contain pus or are such structures as galactoceles

The essential pathological features of carcinoma of importance in the interpretation of roentgenographic shadows are about as follows

The majority are harder and denser than normal breast tissues cysts and benign tumors. They are not encapsulated and most of them have irregular outlines and polyhedral shapes. They spread in four well defined ways as regards influencing X ray shadows (1) by centrifugal growth which both invades and compresses surrounding tissue (2) by sending out longer and shorter prolongations from various parts probably following the lines of least resistance (3) by permeation through lymphatics and (4) by spread through ducts. An important point for consideration is the fact attested by many pathologists that carcinoma cells may spread through the ducts over large areas of the breast from an original even relatively small tumor. This spread through the duct is no doubt now favored and now hindered by the growth spread and vascularization incident to the changes of the menstrual cycle. Another distinct type of carcinoma of the breast consists of the simultaneous or step by step change into carcinoma of various separated parts of the breast i.e. there are multicentric origins. Another important type is the one in which practically the entire breast almost explosively turns at once into carcinoma. This produces the so called *carcinoma en cuirasse*

These physiological and pathological facts considered it is therefore necessary to establish radiological standards for

- 1 Breasts before puberty
- 2 Breasts before climaterium
- 3 Breasts during pregnancy
- 4 Breasts in the climaterium
- 5 Breasts after the climaterium

Study of the breast before puberty meets with a great deal of difficulty. These breasts are small compact and lie close to the thoracic wall their tissues particularly the glandular and fatty tissues are not developed and therefore the radiographic shadows cast are light and indistinct. Due to this it is almost impossible to get a good roentgenogram at this period of life whereby a definite study of the architecture can be made. Fortunately this is not the time of life when the roentgenographic study of the breasts is important.

As would be expected the radiographic appearance in a woman before the climaterium and after puberty shows a distinct variation in the appearance and architecture according to the time of the month i.e. the stage of the menstrual cycle. In a roentgenogram is noted a triangular area with the apex at the nipple and the base along the pectoral fascia. This triangle is shadowed by well defined lines radiating to the pectoral fascia through a more or less homogeneous opacity. The shadow lines are the lactiferous ducts with their accompanying fibrous tissue. The anatomical changes in them and in the intervening homogeneous material give variations in the appearance of this roentgenological triangle as the individual approaches or recedes from the menstrual period. While the details vary the triangle remains occupying about three quarters of the breast as seen in sagittal plane. It is in the disturbance of this triangular area that hints are given for the diagnosis of pathological conditions (Fig 1.)

The details for the normal changes are as follows

In the first few days after the start of the menstrual flow epithelial degeneration is occurring and relatively more space in the breast is occupied by the fatty and hyperplastic connective tissue. Radiographically well defined linear striations with intervening homogeneous shadows are then shown. These linear striations are of increased density because the connective tissue is hyperplastic

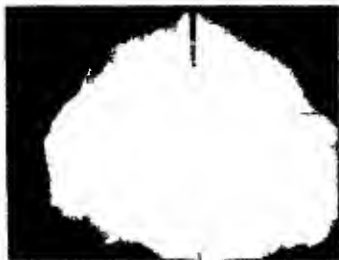


Fig. 1 Normal breast



Fig. 2 Seven days before and seven days after menstruation

their shadows are clear cut well defined and radiate from the main ducts just posterior to the nipple to the pectoral fascia. We have termed this the striated breast triangle. As the subject approaches the next menstrual period the striations become less distinct and gradually wave like outlines are developed at right angles to the linear striations. These wavy striations are lace like fringed usually curved giving a surf like appearance to the entire triangle. As this wavy structure gradually increases the triangle becomes more compact and reaches its maximum opacity about 10 days before the first day of the oncoming menstrual period. This is to be emphasized viz the breast reaches its maximum compactness about a week and a half before and not at the beginning of the menstrual flow. (See Fig. 1.) The increase of this surf like appearance is the mirror of the general hyperplasia of epithelial cells as demonstrated anatomically. The greater the hyperplasia the greater the wave like appearance. Hence the opacities at this time are shadows due to epithelial hyperplasia with coincident regression of connective tissue which therefore increases the density of the breast. At this time namely 10 days before the oncoming of the menstrual flow and continuing after the flow has started the epithelium degenerates and the connective tissue coincidentally undergoes hyperplasia. Vice versa the radiogram shows a decrease in the wave compactness of the breast in density

and a loss of surf like effect as the wavy striations are replaced by the well defined linear striations of connective tissue hyperplasia again surrounding the lactiferous ducts and their terminal lobules.

Mucoid secretion of the epithelial cells during the stage of epithelial hyperplasia also increases the density of the breast thereby giving it a more compact appearance from the radiographic standpoint.

In normal breasts the lymph nodes of both the pectoral and axillary groups cannot be visualized because their density is so nearly that of the surrounding tissue. Hence a normal lymph node will not throw a radiographic shadow sufficient for study.

During pregnancy few if any changes in the radiological architecture that are sufficient for roentgen interpretation are noted before the sixth month following conception. At about the sixth month after conception has taken place the same changes are noted in structure which have previously been described as occurring the week before the onset of the flow of menstruation only on a much greater scale. At this time instead of a fine lacy appearance there is a heavy coarse lacy surf like picture most of which is due to an increase in the number of cells in each lobule with an increase in the number of lobules themselves. For the histology of the breast during pregnancy and to term shows the process to be an hypertrophy and hyperplasia of the gland tissue invading and displacing



F 3 F b m (b)

the fatty tissue with a coincident regression of the connective tissue. However to a lesser extent there is in addition a general engorgement of the breast vascular tissue to provide the increased blood supply necessary for the increase in actual number of cells and their function. The lobule margins gradually fade into the surrounding fatty tissue which the hyperplastic glandular cells are replacing.

The radiographic appearance of the breast after the cessation of the normal menstrual life can be described as an architecture of shrinkage. The linear striations of the breast triangle which represent the contracting connective tissue as well as the lactiferous ducts are crowded together forming a heavier opaque triangular mass lying on the pectoral fascia. In general this dense opaque triangle is the rule but in those cases in which the individual is disposed to adiposity, the triangle may be less dense due to the interposition of fatty tissue in the connective tissue. The linear striations in this period differ from those seen in carcinoma in the fact that they tend to be regular and to radiate from the nipple whereas those of carcinoma may radiate in any direction and as will be stated give a picture of general disruption of the structure of the breast triangle.

It is not unusual in these post climacteric breasts to find small oval irregular shadows with definitely defined outlines imulating those seen in abnormal involution these are small cysts that have been present in the breast before the menopause and have merely been carried over into this period.

One of the most frequent breast conditions

which must be distinguished from malignancy is that of abnormal involution. The differential roentgen diagnosis is often difficult and sometimes impossible when early carcinoma of the breast is considered. The general radiographic picture in abnormal involution is that of a number of small overlapping areas differing in density and distributed in the regions occupied by the lactiferous ducts. These areas at least in the advanced cases are more or less oval and have regular capsule like outlines giving them well defined borders. This well defined border is one of the important diagnostic points distinguishing this condition from carcinoma for the border in small areas of carcinoma has a fading lace like character and is not nearly as well defined. The central portion of these cystic areas is radiographically less opaque hence they have a lighter center and vary in shadow intensity toward the periphery particularly so when compared with the homogeneous opacity of carcinoma. The distribution of the areas of abnormal involution is also somewhat at variance with those of malignancy they always occupy the same distribution as the lactiferous ducts whereas those of malignancy may be found in any location of the breast because their spread is often via the lymph channels. The filling in and increase in the compactness of the ducts is sufficient reason for giving the striated architecture of the breast which represents these ducts a more definite and well defined appearance than is noted in that of malignancy where interruption and displacement of the striated architecture is the rule.

Benign tumors of the breast give a distinctly different radiographic picture from that of abnormal involution and malignancy. Benign growths are usually localized and do not tend to spread they have well defined borders as compared with the fading indistinct border of carcinoma. In carcinoma the architecture is generally disrupted while in the benign growth the linear striation of the breast triangle appears merely crowded to the sides to make room for the growth in other words the growth with its encapsulated outlines is bordered by a general crowding together of the linear striations of the breast triangle.



Fig 4 Concentric carcinoma

The differential diagnosis between a solid benign tumor and a cyst can readily be made by making use of the differences in density between the two conditions. A cyst containing fluid is relatively less dense than that of a solid tumor therefore a positive shadow as a result of the greater photographic effect upon the X ray film. The opposite is noted in solid tumors. A galactocoele may also be demonstrated in this manner. Except for the above differential points cysts and solid tumors have many characteristics which are similar such as a regularly defined outline produced by the capsule and as stated a crowding and displacement of the linear striations of the breast triangle as distinguished from their invasion in carcinoma. (See Fig 3.)

A caked breast comes under the same category as that of the cysts since it will also throw a positive shadow, but the shadows here are multiple and linear in type following the general direction of the lactiferous ducts and their accompanying fibrous tissue. This is a condition of the breast that can be very easily mistaken for that of abnormal involution when only the radiographic evidence is taken into consideration. An inquiry into the clinical history of the patient however will bring a correct diagnosis.

Malignant disease of the breast more especially carcinoma may be demonstrated by the roentgen ray first of all by a general disruption of the normal triangle of the breast. Usually the main mass of the tumor lies some distance below the skin surface and instead of having a more or less linear striated architecture as the normal breast it has a concentric whirling appearance with the greatest opacity at or about the central



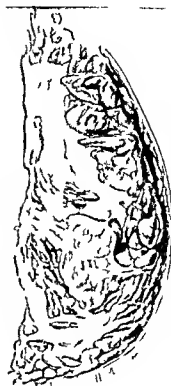
Fig 5 Tumor bridge

portion of the mass. The edges of the mass are fringed and tend toward striation but not necessarily in a triangular form with the apex at the nipple as in normal breasts; rather the radiations have the central opacity of the mass as their center of radiation. (See Fig 4.) There is however in the great majority of malignant breast tumors a band-like radiation from the tumor mass to the nipple but this is more dense and well defined than the usual triangular striations of the normal breast. This banded bridge is an extension from the main mass to the nipple by the way of the lactiferous ducts for as stated the lactiferous ducts are often entirely filled with malignant cells. This bridge is one of the points used in differentiating a malignant mass from an inflammatory area or a benign growth. (See Figs 5 and 6.)

When the roentgenogram is compared with the actual specimen it is found that the dense central opacity consists of the densest part of the malignant growth. As the radiographic shadow decreases in density toward the periphery so the malignant cells decrease in number until finally only rows of cells are seen in the lymphatics or ducts or spaces of the breast tissue. Here they represent an extension by continuity. It is this extension that gives the fringed radiating striations from the central mass. This fringed border of the central opacity is then the result of the extension by continuity of the main mass along the lymph channels lactiferous ducts and spaces. In the early specimen it has a



Fig 6 T m bndge



F 7 Mlgn tg wth smlt g p l

spreading appearance while in the later ones its finger like processes instead of being blunt and rounded are well defined and usually pointed with spicule like projections into the surrounding tissues due to the secondary contraction or general pulling in of the mass itself. The important point in differentiating the radiographic striations lies in the fact that they radiate in all directions instead of fan like with the base at the pectoral border and apex at the nipple. However there may also be a more or less band

like increased opacity which reaches from the main mass to the nipple which consists of malignant as well as connective tissue overgrowth. It is this extension along the lactiferous ducts and their accompanying fibrous tissue network that finally contracts and draws the nipple in giving us what is termed the inverted nipple.

In a great many malignant tumors when the main mass has become large the periphery loses some of its lace like extensions and takes on a more regular appearance simulating a capsule (See Fig 7). This is due to the compression of the outlying malignant cells against the intervening normal breast tissue. In most cases this will not hinder the diagnosis for the other characteristic features of the growth are quite definite. It is this compression caused by the growth of the malignant cells and their crowding one another that gives the whorling appearance which is so typical in these tumors in the later stages however the compression may be so great that the whorl like architecture is entirely



Fig 8 R d i t u g c in ma with b rmal I t i

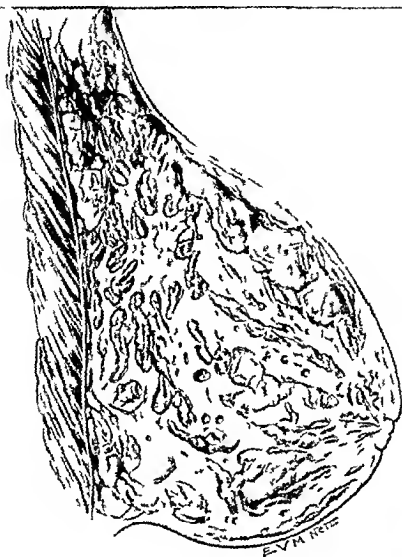


Fig 9 Carcinoma with al normal involution

obliterated leaving only an opaque mass more dense toward the central portion

But it is rare to find only one central opacity in such cases for usually there has been an extension to other parts. Early extensions are shown by the X ray as circular or oval areas of opacity with well defined borders lying here and there throughout the breast. These secondary shadows are thrown by the growths in lactiferous ducts and in lymphatic channels. Those in lymphatic channels are usually more or less linear in outline and striated in type with branching effects and also spread toward the lymphatics of the pectoral and axillary groups. The secondary areas in the earlier cases have sharply defined borders such as are seen in



Fig 10 Carcinomatous metastasis

the shadows cast by benign growths but as they grow older they in turn contract as to the primary growth giving them spicule like borders as in the contracted primary growth. As the case progresses there are more and more extensions and more and more secondary opacities until numbers coalesce to form one great shadow which in some cases may involve the entire breast triangle. This circular coalition of the many smaller areas explains the general whorling appearance of the shadows of the mass. (See Figs 8 and 9)

Due to the fact that many malignant tumors of the breast occur in women after the menopause it is necessary to contrast the malignant breast with the normal breast of this particular period. As stated the normal breast after menopause has a somewhat shrunken or contracted appearance with a compactness that is greater than that of the normal menstruating subject. As far as the compactness is concerned that is the increase in radiographic density it is very much like that of the malignant breast and in some instances can hardly be differentiated. On the whole the radiographic diagnosis is made on the following points first the location of the increased density. In the breast of the menopause it has been found that in general the architecture follows that of the normal menstruating breast. In fact its greatest density appears at or along the pectoral border in a more or less triangular outline whereas in a malignant tumor the opacity may be in any shape or size lying in any portion of the breast. The breast of the menopause practically always presents a single triangular opacity while a malignant breast often presents the multiple shadows. Second after the menopause there is a

general heavy lace like or what has previously been termed a surf like appearance at right angles to the linear striations of the breast triangle. Its density increases as we near the pectoral border while in the malignant breast the architecture has more of a whorling character with fringed borders extending out in all directions into the surrounding tissues of the breast proper.

Metastasis is demonstrated in the pectoral and axillary lymph nodes as a faint opacity on the skiagraph but it has also been found that an enlarged inflammatory lymph node will throw a similar shadow although not as heavy as that cast by the malignant node. It should therefore be borne in mind that all opacities in the pectoral and axillary lymph chain areas must not be considered evidences of metastasis. Since however it has been found that a normal lymph node will not throw a radiographic shadow it follows that when there are opacities of irregular sizes in the region of the axillary and pectoral chains it may be stated that there is pathology present in the area drained by these lymphatics and that it is a malignant growth or an area of suppuration. To determine the difference between these two conditions history physical examination and radiography of the area drained by the nodes will practically always decide. Actually a skiagraph of the main mass of the pathology will very often give the real diagnosis. The radiographic appearance of malignant lymph nodes is that of a chain of small increased densities in the axilla and on the pectoral fascia. The only difference in the radiographic appearance of an inflammatory node as far as can be determined at present is perhaps that its shadow is somewhat less dense. (See Fig 10)

MALIGNANT CHANGES OCCURRING IN BENIGN GIANT CELL TUMORS OF BONE

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THE following paper is an analysis of the giant cell tumors of bone in the Registry of Bone Sarcoma previous to 1925. The study was undertaken chiefly to determine the results of treatment and to learn if they had any relation to the clinical or pathological findings. The cases registered prior to 1925 were chosen in order that at least 5 years should have elapsed since treatment in the most recent case. It was also felt that it would give a fairer idea of the frequency with which malignant changes took place than would be the case if patients dying of metastases were alone reported. It has been my misfortune to have seen 4 cases of giant cell tumor in which death occurred from metastases of these cases were in this series while 2 others have been registered since 1925. Dr. Codman tells me he has also seen several cases and I know of others unpublished occurring in other clinics. It seemed advisable therefore to determine what the actual facts were and whether the occasional case undergoing malignant changes was the exception that proved the rule or whether it occurred often enough to justify more radical treatment than is commonly recommended at present.

In analyzing the cases only those in which a microscopic slide was available for review were studied. There were 113 cases of giant cell tumor registered prior to 1925 which met this requirement. The majority of the Committee of the Registry has agreed to the diagnosis in all of these cases. Four of the 113 cases have been excluded: 2 of giant cell tumor of the phalanx in which the growth obviously originated in the tendon sheaths (441 and 609) and 2 which probably originated in the dura involving the vertebra secondarily (315 and 337). In addition to these 113 there are 12 other cases in which there was considerable difference of opinion among the pathologists as to the correct diagnoses certain of the men classifying the

tumors as osteogenic sarcoma. These cases I have reviewed and accepted 7 as giant cell tumors while 5 were rejected (46 297 409 420 453). There are therefore 116 cases available for study. Four of these patients died of other causes without evidence of metastases less than 5 years from the date of treatment and are excluded and no five year end result was available on 30. There was one postoperative death.

TABLE I

| | C |
|------------------------------------|-----|
| Died of intercurrent disease | 4 |
| No end result | 30 |
| Postoperative death | 1 |
| Available for study of end results | 81 |
| Total | 116 |

The material available in the Registry has been studied carefully by several men and many of the individual cases have also been reported. The most complete review has been made by Kolodny. Codman, Ewing and recently Geschickter and Copeland have also studied the material. There is little in the general study of giant cell tumor to be added to these works and for a detailed analysis of etiology, pathology, etc. the reader is referred to the above articles.

Unfortunately the history in many of the Registry cases is incomplete and the specimens small, poorly preserved, and from only one portion of the tumor. In determining the results the letter from the physician registering the case is all that is available and while this states the patient is living there has been no check up by X-ray to determine whether the growth has been destroyed and the cavity filled in by new bone or whether the bone defect persists. If the latter is the case there is of course always the possibility of a recurrence of the disease.

ETIOLOGY

Sex.—The disease was slightly more common

I R g t y Case 295 G t c l l t m f p p e
d f t h f m Roentg m t k J 922 by
th p t t a f m l y p h y c w h h d g o s i s o f
t b l i s w s n d e (T 96 f m k l d y)

in females than in males. There were 53 or 45.5 per cent males and 63 or 54.5 per cent females. This was true in all bones with the exception of the femur. In the femur the growth occurred in 16 females and 20 males.

The tumor was situated in all cases in the epiphyseal ends of a long bone: the lower end of the femur being most commonly affected. Next in the order of frequency were the upper end of the tibia, lower end of radius and the upper end of the humerus.

The effect of trauma as an etiological factor was noted in 84 cases: 54 or 64.3 per cent had sustained some form of injury prior to the appearance of the tumor while in 30 the fact was stated that no trauma had been received. Pathological fracture was an early symptom in 14 cases.

Age. The disease occurred at all ages but was more common in young adults than in children. It was most frequent in the decade between 20 and 30. When situated in the jaw the average age was somewhat younger. The youngest patient was 4 years; the oldest 68 years while 16 per cent of the cases occurred after 40 years. On plotting the ages the curve was found to correspond almost exactly to the curve that was given by Kolodny.



F g R g t r y C o R t g m t k
A p r i l 9 3 A t t h t m f d m t t h e h p i t l t h
t u e h d n k d p p d f t h f m r h d b
d s t r o y d b y t h t u m o r (F b)

TABLE II—BONES INVOLVED

| | | | |
|-------------|----|---------|---|
| Fem | 36 | U l a | 5 |
| T b a | 4 | R b | |
| F b u l a | 3 | J w | |
| H u m e r u | 8 | V t b | 4 |
| R d u s | | O t h b | |

In other bones are included scapula 3, ischium 1, phalanges 2, astragalus 2, metacarpal 1, sacrum 1, skull 1, and metatarsal 1.

PATHOLOGY

The tumor is essentially a destructive process with bone absorption and relatively little bone proliferation. It originates in the medulla and extends to the cortex which becomes thin and expanded. Kolodny states that new bone is laid down by the periosteum as the new layers of the cortex are absorbed but the entire thickness of the cortex may be destroyed and the tumor contained in a fibrous envelope composed of periosteum. There is much discussion as to the exact nature of the tumor. Mallory considers giant



Fig 3 Registry Case 295. Roentgenogram taken in April 1924. This plate was taken after one series of high voltage X-ray treatments given in the spring of 1923. The tumor has diminished in size and new bone has been laid down (see Figs 1 and 2). Roentgenogram showed no change in the tumor from this date until September 1929. The patient worked as a day laborer from 1924 to June 1929 (Fig 97 from Kolodny).



Fig 4 Registry Case 295. Roentgenogram taken in September 1929. This shows increase in the size of the tumor with absorption of bone and pathological fracture (Compare with Figures 1, 2 and 3).

cell tumor as simple granulation tissue while other observers believe that they are true tumors. Whether this is the same type of giant cell tumor that is seen associated with cases of Paget's disease of the bone it is impossible to say from the data on hand.

The growths were encapsulated unless there had been a pathological fracture. The joint cartilage was apparently very resistant and the joint not involved in any case. This was not true however of the epiphyseal cartilage and one may be misled into making the diagnosis of osteogenic sarcoma by finding portions of this structure in the tumor. There was also no infiltration down the medullary canal, the line of demarcation between normal medulla and tumor being abrupt. Certain bony trabeculae may persist in the growth and give the radiogram a characteristic appearance but they usually do not extend through the entire tumor. In gross the

appearance of the tumor varied considerably. This difference may be due to the age of the tumor but is also affected by trauma or pathological fracture. Different portions of the same tumor may also vary widely in appearance. Many of the tumors were described as being very vascular and having the typical currant jelly appearance on section. The older tumors showed evidence of fibrosis either as the result of treatment, fracture or advancing age.

The appearance of the tumor also varied depending on the bone involved. In the lower end of the femur it was usually seen in the external condyle which often showed evidence of collapse. In the humerus Codman has called attention to two types: one centrally placed while the other apparently originates in the greater tuberosity. These tumors are mostly on the external aspect of the bone. In the phalanx the entire bone was involved when the patient was first seen.



Figs R g ty C 95 Th t m ph f m
l p y f th t m m d 95 Ap l 93 L m
t to Typ l pp f t g t ll t mo

Kolodny has attempted to distinguish types of giant cell tumor and considers four varieties

- 1 Simple giant cell tumor
- 2 Xanthoma



F 6 R ty C 9 Ph t m ph f m t
t t d l f m th f g M l m m g h t
Th h p d l y g w g h g h l y m l g t c m
S t f o m th t m f the th h f m l
ch t

3 Mvomatous

4 Telangiectatic

He believes that these are all forms of the same tumor and found that the pathological



F 7 R try C 68 (C e f G sch Lt d
C pel d) S t f m th t m f th l w d f th
d wh h was u d J ly 99 L w m f
t Th sect s t ly typ l f b g t ll
t m



F 8 R ty C 68 Ph t m ph f sect
f m th t m f th l w d f th d t th t m
f m p t t S p t m b 93 H h m e n h t
S t h w m t typ f p u n d l ll th
m y m t t figu (F 7)

appearance was of little clinical importance. Geschickter and Copeland come to the same conclusion. The appearance varies according to the age of the tumor, previous treatment, and trauma. Different portions of the same tumor may show an entirely different type of growth. It is this fact that makes it difficult to draw conclusions from the small sections present in the Registry. Cartilage, osteoid tissue and new formed bone are often seen although clinically the cavities do not tend to become obliterated by new bone as a result of treatment. *The mere fact that osteoid tissue and new bone is present should not lead one to make the diagnosis of osteogenic sarcoma.*

When situated in the upper end of the humerus the tumors are apt to differ microscopically from the usual form. They all contain large cells suggesting cartilage and at first glance appear as a malignant tumor. All these cases however have been cured by conservative treatment. In the flat bones and jaw the course of the disease is different from that in tumors which are situated in the long bones. In the jaws tumors that suggest osteogenic sarcoma and if in a long bone probably would be clinically malignant may be benign.

In analyzing the specimens microscopically the following points were noted:

- 1 Giant cells—foreign body or tumor form
- 2 Round cells—tumor cells or infiltrative cells
- 3 Spindle cells
- 4 Endothelial leucocytes (foam cells)
- 5 Relative number of cells in mitosis
- 6 New bone—normal or tumor bone
- 7 Cartilage or osteoid tissue
- 8 Blood vessels—tumor blood vessels or normal blood vessels
- 9 Necrosis and hemorrhage

The names of the various cells are self explanatory in most instances. The so called foam cells are phagocytic endothelial leucocytes containing lipid detritus and if present in large numbers give the tumor a yellowish tinge.

The different microscopic structures apparently had no relation to the prognosis of the tumor. Of the entire group there were 19 cases where some question had arisen in the

minds of certain members of the Committee that the disease might be malignant. In studying these cases the results were found to be the same as those in which there was no question as to the diagnosis.

TREATMENT

The treatment of the cases varied within wide limits. Eighty two cases were available for study of which 6 died of metastases. These 82 cases received 20 different forms of treatment or combinations of treatment. It will be seen therefore that there is no standard treatment. The cases are spoken of as well or cured but few are accompanied by X ray pictures to show the actual condition of the bone that is whether the growth is arrested and appears as a cavity crossed by more or less trabeculae of bone or whether the distended bone presented a normal appearance and the cavity was entirely replaced by cancellated bone. It is doubtful if this ever occurs.

TABLE III—ANALYSIS OF CASES

| | |
|----------------------|-----|
| Total no. of cases | 116 |
| No end result | 30 |
| Died of other causes | 4 |
| Available cases | 82 |
| Died with metastases | 6 |

TABLE IV—TREATMENT

| | |
|--------------------------------------|----|
| Amputation | 13 |
| Curettage—amputation | 5 |
| Curettage—radiation—X ray—amputation | 3 |
| Toxins—amputation | 1 |
| X ray—amputation | 1 |
| Curettage | 19 |
| Curettage—radiation | 3 |
| Curettage—radiation—toxins | 3 |
| Curettage—toxins—amputation | 3 |
| Curettage—X ray | 2 |
| Curettage—resection | 2 |
| Curettage—radiation—curettage | 1 |
| Curettage—toxins | 4 |
| Curettage—radiation—toxins—curettage | 1 |
| Excision | 4 |
| Resect on | 7 |
| Biopsy—X ray | 2 |
| Biopsy—toxins | 3 |
| Biopsy—radium | 5 |
| | 82 |

Amputation Amputation as a primary operation was performed 13 times and 10 of these operations were done for tumor about the knee joint. The 3 remaining were one

each of the lower end of the radius lower end of the ulna and a phalanx. All these cases are living without disease 5 or more years later.

Pathologically they varied considerably many were very fibrous but the greater number were typical giant cell tumors. The appearance in 1 case was somewhat suggestive of osteogenic sarcoma (Case 119—radius).

Amputation was also performed 13 times as a secondary operation as other treatment had failed to cure the condition of these 2 are dead of metastases (Nos 68 and 349). In both of these cases the specimens from the first and second operation were available for comparison. They showed an entirely different type of tumor. There is some question as to the actual cause of death in Case 68 but I saw this patient in consultation and she had positive clinical evidence of lung metastases.

TABLE V—RESULTS OF AMPUTATION—TWENTY SIX CASES

| Ampt t | p m y | Ampt t | a th | |
|--------|-------|--------|--------|---|
| c | | t atm | tf led | 3 |
| D d | 3 | De d | | |
| Well | 13 | W ll | | |

In reviewing the cases it would seem that in giant cell tumors amputation when done as a primary operation resulted in a cure in 100 per cent of the cases and that unless the character of the growth had changed from giant cell tumor to an osteogenic sarcoma secondary amputation should also result in a cure.

Resection and excision. Resection or excision was performed 13 times (excision 4—resection 7)—11 times as a primary treatment and in 2 other instances as curetting had failed to cure the disease. Resection was performed for tumor of the femur tibia radius and ulna 1 case each and lower jaw 2 cases. All of these patients are well 5 or more years after operation. Excision was performed 4 times followed in one instance by death with lung metastases. There was no local recurrence. The cases were situated 1 each in the femur fibula vertebra and scapula. The death occurred in the case of giant cell tumor of the scapula. Tb diagnosis was questioned in this case by certain members of the Committee (scapula—63) as the tumor showed

distinct activity in some sections. I believe that the giant cells are both of the tumor and of the foreign body variety and that the tumor was an osteogenic sarcoma.

To sum up resection of a giant cell tumor in the long bones when practical is followed by 100 per cent cures that is the prognosis is as good as in amputation and the results in excision that is complete removal of the growth were equally satisfactory since the patient dying of metastases had no local recurrence.

TABLE VI—RESULTS OF EXCISION AND RESECTION—THIRTEEN CASES

| E c n | D d | W ll |
|-------------------|-----|------|
| Resect o | 4 | 3 |
| Resect o | 7 | 7 |
| s e e d y p r s t | | |

Curettling. Forty six cases were curetted as a primary treatment. There was 1 post operative death from hæmorrhage. How thorough an operation was performed in each case and whether the curetting was followed by cauterization of the cavity or not is impossible to state from the data available. In 17 cases a cure was effected by this method of treatment alone (37 per cent). Twelve other cases in which the curetting was followed by radiation treatment or by the administration of Coley's toxins remained well. These cases might perhaps have been cured by curetting alone. Including them there are therefore 29 cures in 46 patients or 63 per cent. Taking the group as a whole 4 patients died of metastases and one of postoperative hæmorrhage.

In 16 cases in which the primary curetting or curetting followed by radiation or toxin treatment did not cure the tumor 11 eventually came to amputation and 2 to resection while many had a secondary curetting.

The most striking cases in this group are the giant cell tumors of the upper end of the humerus previously mentioned which apparently originate in the epiphysis of the greater tuberosity. These were all cured by a conservative operation. Two notable examples of these are Cases 86 and 5. Certain similar cases have been included in Phemister's group of chondrosarcoma.

The following table gives the results of the cases treated by curetting

TABLE VII—RESULTS OF CURETTING—
FORTY SIX CASES

| | C se | D | d | P | t | W |
|---------------------------------------|------|---|---|---|---|----|
| | | d | d | t | t | h |
| Curetting | 19 | 1 | 1 | 1 | 1 | 17 |
| Curetting—amputation | 5 | 1 | | | | 4 |
| Curetting—radiation—amputation | 3 | 1 | | | | 2 |
| Curetting—toxins—amputation | 3 | | | | | 3 |
| Curetting—radiation | 5 | | | | | 5 |
| Curetting—(multiple) radiation | 1 | | | | | 1 |
| Curetting—radiation—Coley's toxins | 3 | | | | | 3 |
| Curetting—re-ectomy | 2 | | | | | 2 |
| Curetting—Coley's toxins | 4 | 1 | | | | 3 |
| Curetting—(multiple) to ins—radiation | 1 | | | | | 1 |
| | 46 | 4 | 1 | 1 | 1 | 41 |

Radiation Specimens were available for review in only 8 cases which were radiated as a primary treatment one of these cases had an amputation performed later (tibia No 30) and 1 in which the treatment was apparently successful died of local recurrence and lung metastases 6 years later. Radiation treatment therefore in this group of 8 cases resulted in a cure in 6 instances (or 75 per cent). How often there is an error in diagnosis or a change in the character of the tumor it is impossible to state as in most cases treated by radiation the diagnosis is of necessity clinical only. I know of 3 other cases not in this series in which 5 or more years after presumably successful radiation treatment the growth showed renewed activity and presented evidence of metastases. In none of these was the clinical diagnosis confirmed by the microscope. Two of these cases are registered (No 566 and No 917). The third has not been as yet.

In 13 other cases radiation was employed in conjunction with curetting. Three of these cases later came to amputation of which one is dead of lung recurrence (tibia No 349). In this case as well as in Case 295 in which death also resulted from lung metastases a comparison of the specimen removed at the first operation showed an entirely different type of tumor from that removed at the second. In the few instances where X ray plates were available after the radiation

treatment different pictures were presented. In certain cases the cavity remained but the appearance was different from that of an untreated giant cell tumor the trabeculae were not in evidence and the defect in the radiogram had a mottled appearance as if there were many small areas of incomplete ossification. In other cases the tumor appeared to have shrunk but had the general appearance of a giant cell tumor. In still others the cortex appeared to be thicker and the defect although present smaller.

To sum up of 8 cases receiving radiation as a primary treatment 1 died of lung metastases and 1 had an amputation performed later. Of the entire group including the cases in which radiation was given in conjunction with some other form of treatment 21 cases 4 subsequently had an amputation and 2 died of metastases while 15 were cured (73 per cent).

TABLE VIII—RESULTS OF RADIATION—
TWENTY ONE CASES

| | |
|--------------------------------------|---|
| X ray | 2 |
| X ray—amputation | |
| Curetting—X ray | 2 |
| Curetting—X ray—radiation—amputation | 3 |
| Radium | 5 |
| Curetting—(multiple radium—toxins) | 4 |
| Curetting—radium | 9 |
| d d m t a | |

Coley's toxins Fourteen cases received Coley's toxins. In 3 instances it was the only treatment while in 11 cases it was given in conjunction with curetting and 3 of these eventually had the limb amputated. In 1 case the toxin treatment was supplemented by curetting but the patient died with clinical evidence of metastases (vertebra No 472). The specimen in this case is very unsatisfactory but suggests giant cell tumor and not osteogenic sarcoma. In 1 other case Coley's serum was given as a prophylactic following amputation.

To sum up 14 cases received the toxin treatment. In 3 cases it was the only treatment employed and these patients were living 5 years later. In 11 others it was used in conjunction with a surgical operation. One of these died of metastases while 3 required subsequent amputation. Of the remaining 7 cured by curetting and toxin treatment it is

unfair to state which method accomplished the result. Excluding these 7 patients we have 7 patients treated by the toxin of which 3 were cured, 1 died of metastases and 3 required amputation later (42 per cent cures).

TABLE IX --RESULTS OF COLEY'S TOXINS --
FIFTEEN CASES

| | |
|--------------------------------|----|
| Tumor only | 3 |
| Tumor - curettage | 5 |
| Tumor - radiation - curettage | 3 |
| Tumor - curettage - amputation | 3 |
| Tumor (after amputation) | 1 |
| | 15 |

DEATHS FROM DISEASE

Six patients died of metastases as a result of 5 per cent

ABSTRACTS OF CASES

Registry No 63 Male aged 63 years. A tumor of the scapula was excised in 1920. Patient died in July 1921 with clinical evidence of metastases in the lungs.

A review of this specimen shows a cellular tumor containing many foreign body giant cells but there are however many cells in mitoses and multinucleated tumor giant cells as well as tumor blood vessels. The opinion of the Committee varied; certain of the members considering the growth an osteogenic sarcoma. The sections illustrate the fact that diagnosis of giant cell tumor should not be based on the presence of foreign body giant cells alone.

Registry No 68 (Case No. of Geschickter and Copeland). Radus. Female aged 60 years. Tumor was curetted four times between July 1920 and July 1922. Patient also received radium and X-ray treatment. Amputation was performed in September 1923. Patient died December 1923 after a brief illness with clinical evidence of lung metastases. No X-ray examination of chest was made. No autopsy was obtained (see Figs 7 and 8).

There is some doubt as to the actual cause of death in this case. The patient was an elderly woman and the question arose whether death was caused by metastases or by pneumonia and cardiac decompensation. I saw this patient however and believe that she had pulmonary metastases. Sections from the specimen removed at the first curetting are unquestionably giant cell tumor.

Sections made at the time of amputation 2½ years later showed the specimen to be very fibrous and composed of spindle cells without foreign body giant cells in other words a tumor of an entirely different character. Geschickter and Copeland considered that this represents a healing reaction. It suggests however the specimens from Cases 349 and 295 and I believe is a malignant tumor.

Registry No 295 (Illustration Kolodny's article Figs 96 and 97). Upper end of femur. Male aged 23 years. Onset was in June 1922. Biopsy examination made and X-ray treatment began April 1923. Microscopic examination of the specimen showed typical giant cell tumor. Remarkable improvement followed high voltage X-ray treatment and patient was considered cured. He worked as a day laborer until June 1929 when the deformity at the hip joint increased and two nodules appeared in the skin of the leg. One of these was excised and proved to be highly malignant sarcoma. The nodule recurred but disappeared under radiation treatment. The tumor in the hip increased in size and in November there was evidence of lung metastases. The patient died in February 1930. Autopsy showed highly malignant osteogenic sarcoma of the upper end of the femur with lung metastases (see Figs 1, 2, 3, 4, 5 and 6).

There is no question that the tumor from which the first specimen was removed in 1923 was a giant cell tumor and that there was marked improvement following radiation treatment. The tumor found at autopsy was a typical osteogenic sarcoma.

Registry No 349 Case reported by Drs Stoen and Ewing (Case 7 of Geschickter and Copeland). Male aged 15 years. A tumor at the upper end of the tibia was curetted in June 1919. In July 1919 radium treatment was given. In June 1920 a mid thigh amputation was done. In February 1921 patient died with clinical and X-ray evidence of pulmonary metastases. Sections of tumor removed in 1919 showed typical giant cell tumor, thus from the growth in 1920 typical osteogenic sarcoma.

Registry No 47 Female aged 17 years. Tumor of vertebrae result of trauma in 1920. Curetting was done and Coley's toxins were given in 1921. Death resulted from metastases to other bones. Date is not given.

The sections available for review in this case are poor but suggest giant cell tumor. There is no X-ray picture.

Registry No 518 Female age not stated. No X-ray plates are available. The tumor was located at the upper end of the tibia and had appeared

shortly after trauma The tumor was curetted or partially excised in 1924 The patient was dead in 1928 presumably of metastases

The specimen removed at the operation showed a typical giant cell tumor The diagnosis was not questioned by members of the Committee

SUMMARY

In analyzing these cases it is seen that there is no instance in which a proved giant cell tumor formed metastases Cases 295 349 and 68 show that the giant cell tumor may change its character and become osteogenic sarcoma which metastasizes in the usual manner and causes death Whether a giant cell tumor may be malignant or whether it may change its character and cause death is a purely academic question as far as the treatment and the patient is concerned A giant cell tumor is known to become an osteogenic sarcoma in about 37 per cent of the cases It is said that repeated trauma in the way of multiple operations may induce this change from benign to a malignant tumor but after the biopsy Case 295 was treated by radiation and certainly was not irritated for 6 years If we consider the embryonic fibroblast which can differentiate into fibrous tissue bone cartilage muscle etc as being the important cell in all these mesoblastic tumors it is not difficult to conceive of marked changes taking place in the character of the growth I believe that Case 63 was an osteogenic sarcoma containing foreign body giant cells as well as tumor giant cells The data on Cases 472 and 518 is incomplete but the sections show giant cell tumor and do not suggest osteogenic sarcoma and both patients presumably died of metastases The cases cannot be classified as metastasizing giant cell tumors for changes similar to those in 295 349 and 68 may have taken place

The term cure is used to denote the fact that the patient is living 5 or more years after treatment but whether the disease is eradicated or in a quiescent stage it is impossible to state from the data available The fact that in Case 295, a growth apparently cured showed renewed activity and caused death 6 years after treatment should make us cautious in employing the term cure

From an analysis of this group of cases it is seen that the chances of cure are not as great as one is lead to believe from many of the articles published when conservative treatment is employed On the other hand death from the disease does not occur in more than at most 75 per cent of the cases and it is a question therefore if amputation is justifiable I believe that resection should be practiced when possible as the results are as good as those following amputation and better than when following any other method of treatment Resection is practicable in only certain of the long bones the radius ulna fibula ribs lower jaw and humerus and if necessary the deformity can be partly overcome by bone graft In the other bones the choice of treatment lies between amputation on the one hand and radiation or curetting and cauterization on the other The relatively low percentage of cases in which the growth changes its character and causes death would seem to make the more conservative treatment advisable but the fact that the patient may require multiple operations and possibly die of the disease must be borne in mind It is impossible to determine from this small group of cases if radiation treatment or curetting is to be advised in tumors of a given bone

CONCLUSIONS

- 1 Amputation cures 100 per cent of the cases of giant cell tumor
- 2 Resection or complete excision can be expected to cure 100 per cent of the cases The only patient dying of the disease treated in this manner had no local recurrence which is all that can be expected of the operation and there is also some doubt as to the correct diagnosis in this case
- 3 Curetting cures 63 per cent of the cases Combined with other treatment as radiation 72 per cent
- 4 Radiation treatment alone cures 75 per cent of the cases
- 5 Treatment by Coley's toxins cured 42 per cent of the cases (data based on 7 cases)
- 6 Of the cases of accepted benign giant cell tumor treated conservatively 75 per cent died presumably of metastases

7 In 3 cases in which it was possible to compare microscopic sections of the tumor first treated with that causing death the character of the growth had changed from benign to malignant

8 There is no proved instance in the cases of giant cell tumor in the Registry of Bone Sarcoma registered before 1925 of a tumor of this type causing death from metastases. There is definite evidence however that a benign giant cell tumor may change its character and become an osteogenic sarcoma causing death. Uncontestable data is difficult to obtain but this change is known to have occurred in 3 cases in this series 3.7 per cent

1 case of which was proved by autopsy and it may have taken place in 2 other cases 6 per cent

9 The type of giant cell tumor as determined by the microscope apparently has little relation to the prognosis

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PERSISTENT BRONCHIAL FISTULA

EXPERIMENTAL PRODUCTION AND METHOD OF TREATMENT¹

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F m th D p tm t (Surg y U t y f Chi c

BRONCHIAL fistulae following surgical procedures or diseased conditions of the lung close spontaneously in a very high percentage of cases. However when a bronchus of a considerable diameter is severed during partial pneumectomy a persistent bronchial fistula is apt to result. Graham reported 45 cases of cautery pneumectomy 31 or 69 per cent of which became symptom free with 10 or 33 per cent having persistent bronchial fistulae.

ETIOLOGY OF PERSISTENT BRONCHIAL FISTULA

Several factors have received attention in considering the etiology of this condition (a) The lumen of a persistent fistula is usually lined by either a stratified epithelium squamous to columnar in type or by chronic unhealthy granulation tissue. Investigation of the reparative processes of bronchi of dogs following an injury (1) revealed the bronchial epithelium regenerating very rapidly. The rate of regeneration was such that before the defect left by the necrosing action of the injurious agent could be filled in with granulations the enlarged air passage had become relined with new epithelium. Similar observations were made by Winternitz during influenza studies on rabbits. Thus simple destruction of the epithelial lining of a fistula would be followed by rapid regeneration rather than closure of the sinus. (b) Examination of the wall of a persistent fistula reveals a firm rigid non collapsible structure consisting of dense fibrous tissue. The lumen thus being kept open is thought to be an important factor in preventing a closure. (c) A very high percentage of bronchial fistulae exhibit a continuous or intermittent discharge. The source of this may be at the inner end of the fistulous tract or at any point along its tortuous course which may be inadequately drained. Undoubtedly this continuous rein-

fection plays a major rôle in preventing a closure of the pathological sinus.

EXPERIMENTAL PRODUCTION

The experimental production of persistent bronchial fistulae in dogs was carried out by Pool and Garlock. They reported great technical difficulties accompanying the procedure with tendency of the fistulae to close spontaneously. Their method entailed the use of a two stage operation at the first of which a segment of rib with intercostal muscle and periosteum was removed and the underlying lung sutured to the parietal pleura over an area 1.25 inches in diameter. At a second operation weeks later the lung was entered by blunt dissection and on reaching a fair sized bronchus we sutured the bronchus to the skin edges. The fistula thus formed was kept patent with difficulty by frequent applications of phenol.

The experiments that follow deal with the production of bronchial fistulae the persistent bronchial fistulae and a method of closure of persistent fistulae.

Medium sized dogs were used (11 to 13 kilogram) in the experiments and the operations were carried out under ether anesthesia with a small pre operative dose of morphine and atropine. A two stage operation was performed as follows. At the first operation about 75 per cent of the middle lobe of the right lung was delivered outside the chest wall and secured to the intercostal muscles by a row of silk sutures. The soft parts were then closed in layers outside the lobe of the lung. At a second operation 2 weeks later the portion of the lung lobe outside the chest wall was amputated with the actual cautery. Into the main bronchus of the lobe thus exposed a rubber tube about 0.6 centimeter in diameter was introduced for a distance of 2.0 or 3.0 centimeters. The skin edges were closed about the tube which was secured in

place by means of a safety pin and body cast. The wound was dressed daily and the body cast was removed in 2 or 3 weeks following the second operation. The experiments were concluded by electrocution (11) to avoid agonal phenomena. The specimens obtained were examined both grossly and microscopically.

Protocol 1 September 20 1929 Dog No 294B weighing 9.5 kilograms was given morphine 0.015 gram and atropine 0.0004 gram before operation. The right chest was prepared for operation by shaving and by application of tincture of iodine. Under intratracheal ether anesthesia an incision about 2 inches in length was made over the posterior half of the right sixth rib. This was carried down to the rib of which 2 inches were resected subperiosteally. A longitudinal incision was now made in the rib bed 1.5 inches in length (Fig. 1) and 75 per cent of the right middle lobe of the lung was delivered outside of the chest wall under positive pressure ether anesthesia (15). The lobe was secured in this position by a single row of continuous silk suture (Fig. 2). The muscle, subcutaneous tissues and skin were then closed in layers outside the lung lobe, catgut being used for the muscle and fascia and interrupted linen for the skin. A dressing was applied and as secured with collodion. The postoperative condition was good.

September 21 1929 The dog was quiet and would not eat. Appeared ill.

September 22 1929 Appeared ill. Did not eat but walked about in cage.

September 3 1929 Better today. Wound clean.

September 5 1929 Dog up and walked about well. Wound clean.

September 27 1929 Appeared entirely well.

September 30 1929 Wound healed.

October 4 1929 Morphine 0.015 gram and atropine 0.0004 g. were given before operation. Under intratracheal ether anesthesia an incision about 1.5 inches in length was made in the region of the scar of the first operation. This was carried through the skin, subcutaneous tissue and muscle. The right middle lung lobe was located and separated from the surrounding tissues by blunt dissection down to the row of silk sutures. It was then amputated with the actual cautery at a point just distal to the silk sutures (Fig. 3). Hemostasis was easily obtained with the cautery. Into the main bronchus of the lung lobe thus exposed a rubber tube 0.6 centimeter in diameter was introduced for a distance of 2.0 to 3.0 centimeters. The skin was then closed over the stump and around the tube by interrupted linen sutures (Fig. 4). The tube was secured by a safety pin and after dressing the wound a body cast was applied. Postoperative condition good.

October 5 1929 The dog appeared ill and did not eat.

October 7 1929 Hole cut in cast over wound and tube found in proper place. Wound cleaned with iodine and alcohol. Cast reinforced.

October 9 1929 Wound infected. Tube in place.

October 10 1929 Cast changed. Wound still infected. Cleaned with iodine and alcohol.

October 12 1929 Same. Dressings changed.

October 14 to 18 1929 Wound infected but healing. Dog otherwise appeared well.

October 19 1929 Cast taken off and the tube removed. Bronchial fistula present and much infected.

October 20 to December 20 1929 Fistula observed daily. It remained patent but did not decrease in size and discharged a small amount of purulent material.

December 20 1929 to February 1 1930 Fistula observed daily. Continued to be patent and of original size. Was discharging purulent material at all times.

February 1 to August 31 1930 Fistula observed daily. During this period it remained of quite uniform size (1.0 by 0.75 centimeter) and discharged a small amount of purulent material (see Fig. 5).

August 31 1930 Sacrificed by electrocution.

RESULTS

The results of 11 experiments as described above are as follows:

Two dogs died on the second day following the second operation: one due to hemorrhage from clawing the wound through an opening eaten in the cast; the other presented no demonstrable cause of death.

THE PERSISTENT FISTULA

Three of the 9 remaining dogs were sacrificed at the end of 6, 11 and 11 months respectively. One of the animals retained a persistent bronchial fistula of 1.0 by 0.75 centimeter throughout the entire experiment of 11 months duration. The fistula of the other dog sacrificed at 11 months ceased to discharge on two occasions and began to close spontaneously which necessitated reinfection by introduction of a dry pack into the fistula. It ceased to discharge completely and closed spontaneously just before sacrificing. The 6 month specimen also ceased to drain and began to close spontaneously on three occasions at which time a dry gauze pack was introduced into the fistula followed by reinfection and discharge of pus. At the time of sacrifice the fistula was its original size and discharging pus.

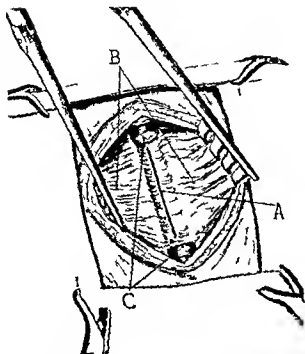


Fig 1 First stage operation for experimental production of bronchial fistula. A Longitudinal incision in rib bed B intercostal muscles and parietal pleura C ends of rib following subperiosteal resection

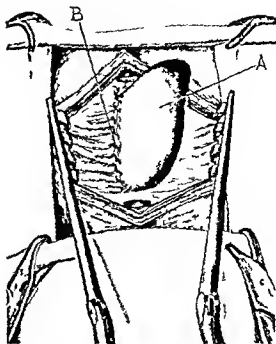


Fig 2 First stage operation for experimental production of bronchial fistula. A Right middle lung lobe drawn out through opening in rib bed and secured by a single row of silk suture at B

Gross pathology At autopsy the external opening of the persistent fistula was oval in shape and measured 1.0 by 0.75 centimeter

The adjacent lung lobes were adherent to the lobe containing the fistula and chest wall at the site of operation by quite dense fibrous adhesions. On dividing the fistulous tract it was found to be fairly uniform in diameter throughout its course. However a small recess was located between the lung lobe and

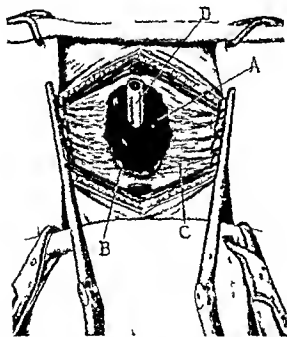


Fig 3 Second stage operation for experimental production of bronchial fistula. Note stump of amputated lung lobe A line of suture just proximal to where amputated B intercostal muscles and fibrous adhesions C rib tube in main bronchus of lobe D distal end of amputated lung lobe

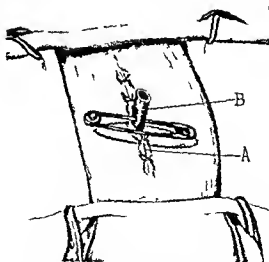


Fig 4 Second stage operation for experimental production of bronchial fistula. Showing line suture closed around tube B which is located in main bronchus of lung lobe



Fig 5 D N 94 B P t t b o h i f t l a
f o 5 m o t h d t o w i t h n t d n e y t p o n t
c l o a t y t m U p p r i g h t c l s e p w
T h f i t l m e d o 7 5 b y o c e n t m t

skin surface and extended around the entire circumference of the fistula in which purulent material was found (see Fig 6)

Microscopic pathology The fistulous tract was lined by a stratified epithelium which varied from squamous to columnar in type. There was no sharp line of demarcation between the two types the squamous extended three fourths of the distance inward toward the lung in some parts and the columnar extended three fourths of the distance outward toward the skin surface in others. The lining epithelium lay on a fibrous tissue base (Figs 7 8 and 9)

CLOSURE OF THE FISTULA

The treatment of persistent bronchial fistula dates back to Hippocrates who is quoted as having given up in despair and advised letting nature take its course

Graham (6) found in his experience that it was better to wait for a period of months or years before attempting to close the fistula. The many procedures reported for the cure of persistent bronchial fistula suggest its stubborn resistance to any form of therapy. Such procedures as mobilization of the lung (5 10 13) cauterization of the lining of the fistula pedicle muscle graft (13 16) fat and fascial transplant (9) and suture of the fistula (5 9 13) have been reported to have produced satisfactory closure of persistent bronchial fistula in individual cases

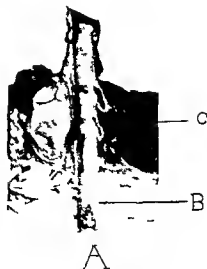


Fig 6 D No 369 C Phot ph f p t l c a l
p m f p r s t e t b h i f t l s c n h d t t h
d f w k d u t N t d t l p t s f
f i t l B l y n b t n o t e m d l t s s
C l g

From studies on the healing of bronchi Bettman concluded that the healing was due to peribronchial tissue. It was also noted that both Lilenthal and Joannides in doing experimental lobectomies left a liberal amount of parenchymal tissue in order to obtain a successful closure of the stump. Roban on and Sauerbruch (quoted by Bettman) were unable to perform pneumectomies on dogs due to lack of healing of the bronchial tissue. In some experiments on bronchial injury and repair (1) in which the entire bronchial wall was destroyed it was found that there was only regeneration of the lining epithelium and this occurred rapidly.

Recent further studies have been made on the repair of bronchi following injury (2 3) in which various percentage strengths of silver nitrate were used. Complete stenosis of a bronchus 1.0 centimeter in diameter followed the application of 35 to 50 per cent quite routinely in from 2 to 3 weeks. On the basis of these experiments it seemed reasonable to believe that a persistent bronchial fistula might be stenosed in a similar manner.

Accordingly 6 of the above produced persistent fistulae after having progressed for 5 months received a single application of

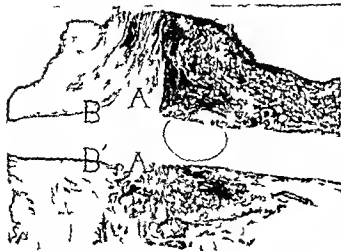


Fig 7 Dog No 369C Microscopic appearance of fistula seen in Figure 6 Note recess A between ostium and lung tissue (X4)

silver nitrate solution introduced to a depth of 1.5 centimeters into the fistulous tract. In 3 dogs 35 per cent was used and in the remaining 3 a 50 per cent solution was applied. A constant discharge from the fistula was present in each case at the time of application of the silver nitrate. Prompt closure of the fistula took place in all cases in from 8 to 14 days it being slightly more rapid following the 50 than the 35 per cent. The animals were sacrificed 3 to 5 weeks following closure of the fistula.

Gross pathology At autopsy the distal portion of the fistula ended blindly beneath the skin. This closure appeared to be brought about by dense fibrous tissue (Fig 10).

Microscopic pathology The blind end of the fistula was lined by stratified columnar epithelium and showed some evidence of polyp formation. The region between the blind end of the fistula and the skin surface was composed of fibrous and adipose tissue (see Figs 11, 12, 13).

DEDUCTIONS

Persistent bronchial fistulae which are acting as a safety valve for some obscure suppurative process obviously should not be closed. On the other hand large empyema cavities or cavities remaining following partial pneumectomy into which several bronchial fistulae open are very difficult to heal without first closing the bronchial openings.



Fig 8 Dog No 369C High power at B of Figure 7 showing stratified squamous epithelium lying on a fibrous tissue base (X175)

The pathological specimen of the persistent fistula described strongly suggests incomplete drainage with continuous discharge of purulent material to be very important factors in the etiology of their persistency. This is substantiated alike by those fistulae which tended to close spontaneously with the cessation of their discharge and by other fistulae which persisted indefinitely always presenting a discharge of purulent material. Another factor of etiological importance was brought out by the following observation with the cessation of discharge from the bronchial fistula and the clearing of its infection it was impossible to cause a reinfection by repeated injections of pathogenic organisms into or around the fistulous tract. However with the introduction of a foreign body such as a piece of gauze into the passageway reinfection



Fig 9 Dog No 369C High power at B of Figure 7 Wall of persistent fistula showing stratified columnar epithelium lying on a fibrous tissue base (X175)



Γ g D g N 7 B Ph t ph f p th t l
p f b ch al f st j z m th f ll j
t y p t l t ate Th f t l h d p t d f
l t t l t d weeks f ll g ppl t f

immediately followed and was associated with discharge of pus. This demonstrates very clearly how delayed healing of a pathological sinus may be due to a foreign body lying in some obscure portion keeping the sinus infected.

In some recent studies on the treatment of pulmonary suppuration repeated applications of a silver nitrate solution to the bronchus of



F D N 3B Nl p c pp a ce of
h l d b h l f t l 3 w e k s f l l g c l e th 5
p c t l t t l t Th f t l of 9
w k d t wh t da d closed 8 d y foll
t t N t polyp f m to l (X3)

a lobe containing a suppurative process failed to produce complete stenosis in the presence of a constant discharge of pus. Here was a condition comparable to a persistent fistula acting as a safety valve e.g. a source of infection with only one exit for drainage. The failure of stenosis of this one exit may well be defined as a physiological process on the part of the animal to maintain an outlet for the purulent discharge. Contrasted to this was the prompt closure of persistent fistulae from which pus was exuding. This closure of persistent fistulae was very similar to the stenosis of a normal lung lobe bronchus which routinely followed an application of a silver nitrate solution (2).

Very large bronchial fistulae occur occasionally, the proximal end of which may be seen through the bronchoscope. The possi-



F D N 3B Lo t l Γ g Sh
bl l d f f t l l t t B l d t
t k f (X8)



F 3 D N 13B H h pow t l l Γ
t t t f d l m p th l m ly nb
t b

bility of closing these fistulae via the bronchoscopic route suggests itself when it is seen how readily complete stenosis of one of a dog's primary bronchi occurs following a single application of the cauterizing agent

SUMMARY

1 Procedures for the experimental production of persistent bronchial fistulae are described

2 A method of closure of persistent bronchial fistulae is presented

3 Closure of a persistent bronchial fistula and stenosis of a normal bronchus of a lung lobe are compared

4 Closure of the bronchus of the lung lobe containing a suppurative process and a bronchial fistula acting as a safety valve are compared

5 Closure of a persistent fistula and of a bronchus of a lung lobe containing a suppurative process are contrasted

We wish to thank Mr Leo Hrdina for his suggestions and assistance in this experimental work

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THE ASCHHEIM-ZONDEK PREGNANCY REACTION

EFFORT BASED ON TWO THOUSAND CONTROLLED ASCHHEIM ZONDEK PREGNANCY TESTS

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SINCE the innovation of the Aschheim Zondek reaction over 2 years ago I have made several short reports concerning experiences in our clinic with it. At the present time (January 1931) we have made more than 2,000 controlled Aschheim Zondek tests and without any knowledge of the clinical picture have secured a 98 to 99 per cent correct diagnosis in each instance.

It is of course true that as in all other biological reactions the results obtained depend largely on the experience and technique of the individual investigator. Though the technique of making the test itself is quite simple there are nevertheless many details that must be mastered. I believe it goes without saying therefore that an investigator who has not the necessary experience cannot obtain the best results. I have become thoroughly convinced from our experience that it is fairly easy to make mistakes in identifying reaction I and differentiating it from reactions II and III; this is true especially if the investigator is not fully acquainted with the morphology and biology of infantile rodent ovaries. I am also convinced that sometimes the many so called inaccuracies are due not to the reaction itself but to the individual investigator. The clinician therefore should bear in mind that the value of the report on the Aschheim Zondek reaction depends to a great extent as it does in the Wassermann reaction on the ability of the investigator who makes the test.

MORTALITY OF THE TEST ANIMALS

The mortality in the test animals is fairly large. In my experience it was as high as 20 per cent and other authors have reported similar percentages. This high mortality is due in part to the toxicity of the urine and in part to the lack of resistance of the test animals. Recently Zondek has published a description of an ether detoxicating method (the urine is shaken thoroughly with two to four times its quantity of ether) which has reduced the mortality percentage in the test animals. For the past 4 months I have been using this detoxicating method in all urine hormonal tests in our clinic.

Unfortunately it is not possible thoroughly to detoxicate all urine by this method. This has been found to be especially true of the urine of pregnant animals as has been demonstrated by Dr. Bornstein and myself.

At the end of the 100 hours all the test animals may still be alive but some of them may be in a somewhat weakened condition. It is thus evident that the mechanism of the hypophyseal hormone reaction will be somewhat disturbed in animals that are weakened physiologically. If in these mice autopsy reveals positive reactions (blood points and corpora lutea) then the results are quite reliable. On the other hand if autopsy yields negative or positive results for reaction I the results must be cautiously interpreted. To be reliable the test should be based upon the results found in 5 undamaged healthy test animals.

SELECTION AND NUMBER OF TEST ANIMALS

The Aschheim Zondek reaction is a biological one in that the test object is the ovary of the infantile mouse. Thus the test object is subjected to all the variations of life. If we use in each reaction 5 infantile mice or in other words 10 infantile ovaries it gives us 10 biological test objects to work with. In this way it is possible to reduce the source of error to a minimum of 1 to 2 per cent.

The claims for accuracy in the Aschheim Zondek reaction cannot be fulfilled in an ideal way if instead of 5 mice only 3 or even 4 are used. Such technique can in no way be approved of for unless properly done the reaction may be brought into ill repute. Test animals may possibly be spared not at the beginning but at the end of the test but only in selected cases namely when the reaction is positive. If but 1 blood point or but 1 corpus luteum makes its appearance the test is indicative of pregnancy. This finding at autopsy in even 1 animal makes the diagnosis indisputably clear. For the past year I have not killed all 5 animals at one time but have examined but one animal at a time. If the results in the first are clearly positive then it is not necessary to sacrifice the 4 other animals. It goes without saying that if the reaction is negative or in doubt each animal must be examined.

Rac 1-e la m f d t p d
Rc 11-hæmorrhagic (blood point) 1 I di t
Rca 111-form 1 co po 1 ca 1 p g

HYDATIDIFORM MOLE AND THE PREGNANCY REACTION

Every gynecologist knows how often it is difficult to diagnose hydatidiform mole often the clinical picture distinctly points to hydatidiform mole and yet absolutely definite proof is lacking. It is important to know therefore that in the course of the last year a noteworthy addition has been made to our knowledge of the symptomatology of hydatidiform mole. For quite some time in addition to the known clinical symptoms there has been noted an extraordinarily characteristic biological symptom namely the abnormal high concentration of the anterior hypophyseal hormone in the urine and blood. From the investigations of Aschheim Zondek Robert Myer Roessler Fels Philipp and myself we know that the urine of a patient with a hydatidiform mole contains very large quantities of anterior hypophyseal hormone and that a very minute amount of urine will give a positive Aschheim Zondek pregnancy reaction. We are therefore in a position to establish a definite diagnosis of hydatidiform mole in doubtful cases by a quantitative urine analysis. I have cited two such cases in the first patient the reaction was positive with 1/520 cubic centimeter of urine and in the second with 1/260 cubic centimeter. At the present time I am following another case of hydatidiform mole in our clinic in which it has been possible to corroborate the suspected clinical diagnosis by the huge hormonal content of the urine. It is also noteworthy that in this case the liquor amni also gave positive reactions II and III. We have made it a rule carefully to follow and treat all patients with hydatidiform mole until the hypophyseal hormonal reaction I becomes negative.

CHORIO EPITHELIOMA AND THE PREGNANCY REACTION

In the contributions of Aschheim Zondek Roessler Fels Hirsch Hoffmann Robert Myer and myself details are given concerning the results produced by a chorio epithelioma in the Aschheim Zondek reaction. We know that in the majority of the cases the blood and urine of a patient with chorio epithelioma gives a positive pregnancy reaction. In many cases as in the hydatidiform mole the hormonal content of the hypophyseal hormone is abnormally high. In a case of chorio epithelioma of the kidneys Robert Myer demonstrated 70 mouse units of hormone per cubic centimeter of urine likewise in a case of testicular chorio epithelioma Fels showed the presence of 33 mouse units per cubic centimeter of

urine. I also reported a case of primary chorio epithelioma of the uterus which gave in a quantitative urine analysis 100 mouse units per cubic centimeter of urine. The case just referred to deserves special notice in that it illustrates that on suspicion of chorio epithelioma an exact diagnosis can be obtained by a hormonal analysis of the urine. Thus in the future in all cases that clinically are suspicious of chorio epithelioma an exact hormonal quantitative analysis should be made in this way doubtful clinical diagnoses can be checked up as early as possible. In the follow up management of these cases the anterior pituitary reaction after a few weeks or months is negative just as it is in hydatidiform mole. In cases that take a malignant course the reaction remains positive and such cases of course must be given proper treatment. In any case the patient must be kept under observation until the reaction is definitely negative. It is of value to examine the urine at regular intervals so that if there is any possible recurrence it may be recognized as early as possible.

AN ARTIFICIAL PREGNANCY REACTION IN THE NON PREGNANT WOMAN

I have previously reported at length concerning the behavior of the anterior lobe hormone of the hypophysis in the non pregnant woman. In my investigations I transfused the blood of pregnant women into non pregnant anæmic women. I examined the blood and urine hormonal content of the latter and found

1 After a transfusion of 500 to 700 cubic centimeters of pregnant blood (1 500 to 7 000 mouse units of anterior hypophyseal hormone) I was able to demonstrate reactions II and III in the blood stream from 20 hours after the transfusion. Soon after this the blood gave only a positive reaction I and still later the reaction was entirely negative. These results seem to show that the body has the power and the ability to eliminate in a fairly rapid manner large quantities of hypophyseal hormone from the blood stream.

2 As to the fate of the remainder of the hormone a urine analysis demonstrated the following: urine secreted in the first 24 hours gave positive reactions II and III; in other words the sudden loading of the blood stream with extraneous hormone was excreted at least in its greatest part in the first 24 hours in the urine.

3 Through investigations of successive single urine analyses I found that the excretion of the hormone in the urine appears as early as 10 minutes after the beginning of the transfusion and continues for from 12 to 24 hours.

4. These results bear some important relation to the question of dosage: they show that it is not possible by our therapeutic procedures to work with large quantities of hypophyseal hormone: an extra load will be excreted in the urine. For this reason it would seem that the repeated administrations of small doses of hypophyseal hormone would be more practicable and physiological.

5. The investigations described show that the organism of the non pregnant woman reacts to the hypophyseal hormone largely in the same way as the body of the pregnant woman reacts for a flooding of the blood stream with large quantities of hypophyseal hormone in the non pregnant just as in the pregnant woman produces a positive even though transient Aschheim Zondek pregnancy reaction.

Further clinical investigations (not as yet published) have also demonstrated that after the intravenous administration of large quantities of hypophyseal hormone a positive reaction II and III is obtained in the urine.

THE CLINICAL SIGNIFICANCE OF REACTION I

It is well known that Aschheim and Zondek have grouped the actions of the anterior lobe hormone into 3 phases: reactions I, II and III as explained above.

Reaction I is not significant in the diagnosis of pregnancy for it may occur in the presence of slow as well as rapidly proliferating tumors (myoma carcinoma) in the presence of diminishing genital function at the beginning of the menopause and

in certain types of amenorrhoea. Two years ago I reported a case of a 35 year old woman with a high degree of genital hypoplasia: her urine and blood gave a positive reaction I over a period of 10 months. In cases of this sort it is apparent that reaction I indicates a hyperfunction of the anterior hypophysis with subsequent overproduction of the hypophyseal hormone. This theory is supported by the parabiotic investigations of Matsuyama.

For the diagnosis of carcinoma at the present time at least reaction I has no real worth since it is positive in a good many cases of benign tumors; however it is not improbable that in the near future with the further development and refinement of technique it may be more definitely significant in the diagnosis of early malignancy of the female genital tract.

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CLINICAL SURGERY

FROM THE CINCINNATI COLLEGE OF MEDICINE

THE SURGICAL APPROACH AND THE TREATMENT OF TUMORS AND OTHER LESIONS ABOUT THE OPTIC CHIASM

GEORGE J HEUER M D F A C S CINCINNATI OHIO

THE purpose of this review is to trace the evolution of the operative approach to lesions about the optic chiasm to note the advances which have been made in our knowledge of the many lesions in this region which may cause optic atrophy and visual disturbances and to comment upon our present conceptions of the treatment and the results of treatment of these lesions. While very restricted in its dimensions the region about the optic chiasm is the starting point of a variety of tumors and other conditions the number of which certainly equals if it does not surpass any other single region of the brain. Moreover the clinical manifestations of these conditions are of such variety that they concern the physician ophthalmologist neurologist endocrinologist, rhinologist roentgenologist and surgeon. As a result the literature on the subject is widely scattered and unfamiliar to the majority for we find that while the diagnosis of primary hypophyseal tumors is usually made the more recently discovered conditions about the optic chiasm which also cause optic atrophy and visual disturbances are but little understood.

As so often happens in medicine the discovery and adoption of a new method is immediately followed by a great advance in our knowledge of a subject. The intracranial approach to the chiasmal region is certainly not a new method but its adoption in any general sense has been long delayed. Coincident with its more general use in recent years has come a great increase in our knowledge of the pathology clinical manifestations and diagnosis of a variety of conditions about the optic chiasm which as urgently demand treatment as the primary hypophyseal tumors. Its very importance in the development of our knowledge of the subject is my reason for first considering the evolution of the various operations which from time to time have been suggested and used in the exposure of the chiasmal region. I may perhaps best discuss them under intra-

cranial and extracranial operations the prototype of the former being the now commonly used transfrontal approach that of the latter being the well known transphenoidal approach.

INTRACRANIAL OPERATIONS

The temporal or subtemporal approach. The intracranial approach to hypophyseal tumors antedated the transphenoidal and the first to be suggested was by the temporal or subtemporal route.

Caton and Paul in 1893 acting on Horsley's suggestion attempted to approach the hypophysis by a lateral subtemporal route. The idea was to elevate the temporal lobe sufficiently to expose the chiasmal region (Fig. 1). The operation was not completed the patient dying before the second stage was undertaken. Horsley himself is said consistently to have followed this route to the chiasmal region and while his own statements regarding the matter are meager Cope states that Horsley operated upon one case of hypophyseal tumor as early as April 1904 and had done 20 hypophyseal operations with 2 deaths by 1906. Casselli, Paulesco and Cushing used this approach in hypophysectomies in experimental animals and it has remained the approach of choice in experimental work. Casselli probably as a result of his experimental work also suggested its use in the approach to the hypophysis in man but I have been unable to discover that he successfully carried it out. Cushing (15) attempted it in 6 cases but in only 1 was he able to expose the chiasmal region and partially remove a tumor. Dahlgren is stated to have approached the hypophysis through the middle fossa after opening the dura and retracting the temporal lobe.

Frontal approach. So far as I can gather Krause (60) was the first to suggest a transfrontal approach.

At a meeting of the Berlin Medical Association October 24, 1900 Krause demonstrated a cadaver preparation showing his method of approach. It consisted in the formation and elevation of an



Fig. The transfrontal approach to the sella turcica.
(Brit. Med. J. 1933, 4, 4)

osteoplastic flap 5.5 centimeters in the transverse and vertical diameters above the supra-orbital ridge. The extradural elevation of the frontal lobe to the lesser wing of the sphenoid, the incision of the dura at this point and the exposure of the optic nerves, the chiasm and hypophysis through this dural opening. At this time he had not used it upon the living subject but subsequently he removed a tumor of the base by this approach. Borchardt in 1908 attempted to expose an hypophyseal tumor by this method but failed to complete the operation. In the second stage of a two stage procedure he encountered such dangerous hemorrhage that he abandoned the operation before the hypophysis was exposed. He then did a successful partial resection according to the method of Schloffer. In his original communication Krause states that an oblique frontal approach is better than a direct frontal approach and later he modified his operation by reflecting a large dural flap thereby converting an extradural approach into an intradural approach. By this method he successfully exposed and removed an hypophyseal tumor (1909). While Krause himself seems to have performed but few operations for hypophyseal tumor his operation has served as a model for almost all subsequent frontal operations.

Kilian in 1904 proposed a very radical procedure which contemplated the formation and reflection upward of a large Wigner flap including both frontal bones and the reflection of an equally large dural flap which necessitated the ligation of the longitudinal sinus. The frontal lobes were elevated and the chiasm approached from within the dura (Fig. 2). The operation was suggested because of the author's conviction that an extradural approach was without value in the exposure of the chiasmatic region. Kilian's operation was then one of the first transfrontal intradural approaches suggested. I cannot find that it was ever used in the approach to an hypophyseal tumor in a living subject.

Bogojawlensky in 1911 reported an operation by means of which he had successfully exposed and removed an hypophyseal tumor. The operation was Krause's later intradural approach, the only modifications being an H shaped incision in the dura so that a dural flap was reflected upward and downward and the use of the overhanging position of the head. The exposure was sufficient to enable the operator to see the relations of the tumor to the optic nerves and chiasm. His patient recovered and the case is one of the three first successful tumor extirpations by the transfrontal approach.

McArthur in 1912 described a frontal approach which differs from any of the preceding. A cutaneous periosteal flap is reflected over the frontal bone. The frontal bone including the supra-orbital ridge and anterior half of the orbital plate is completely removed and placed in salt solution and the posterior part of the orbital plate back to the optic foramen is rongeuré away. The frontal lobe is elevated, the orbital contents depressed and the region of the anterior clinoid processes approached extradurally. At a point between the anterior clinoid processes an incision 2 to 3 centimeters in length is made in the dura and the chiasmatic region is exposed. At the termination of the operation on the frontal bone is replaced as a free transplant (Figs. 3, 4, 5, 6 and 7). McArthur records 3 cases operated upon by this method.

Frazier (32) in 1913 proposed a transfrontal approach which was a modification of McArthur's method. An osteoplastic flap over the frontal region is reflected laterally. The supra-orbital ridge is exposed and removed as a separate fragment and subsequently replaced as a free transplant. The frontal lobe with its dural covering is elevated, the orbital contents depressed and the chiasmatic region approached extradurally. Upon exposure of the region of the sella the dura is incised horizontally and sufficiently widely to admit the blade of the elevating retractor. The optic nerves and chiasm are then brought into view. Frazier (33) subsequently (1919) modified his operation changing it from an extradural to an intradural approach. In his later operation the resection of the supra-orbital ridge remains the same but he has abandoned the removal of the orbital plate. The dura is opened

widely in a line concentric with the frontal bone flap and from the orbital border of this incision a counter incision is carried downward and backward toward the sella (Figs. 8, 9, 10 and 11). The author states that the exposure is greater and more easily obtained than in his original extradural approach. More recently (1928) he (34) suggests the approach to the chiasm at an angle 15° along the greater wing of the sphenoid rather than directly from in front because in the latter he has observed a remarkable fall in blood pressure which has been absent in the former. He suggests also a bilateral frontal approach 3 months apart in some of the larger tumors because of his inability properly to explore the portion of the tumor on the side opposite

his primary approach. Still more recently (1930—personal communication) he states that he has again modified his operation. The scalp flap is reflected forward so as to eliminate one of the skin incisions in the forehead. A rather small bone flap fashioned above the frontal sinus is reflected toward the temporal region. The supra-orbital ridge is not resected as in his earlier procedure. An incision is made in the dura parallel with the anterior margin of the bone flap and the frontal lobe is elevated within the dura. The approach to the chiasm is from the side along the greater wing of the sphenoid. In Frazier's hands therefore the operation has been developed into a lateral intradural approach.

Since Frazier's contributions there have not been any noteworthy additions to the frontal approach. Such additions as have been made are of the nature of modifications of his method. Cushing (15) makes use of a transfrontal extradural approach, i.e. the earlier approach of Frazier but without the resection of the supra-orbital ridge (Figs 1, 13, 14, 15). Elsberg includes a part of the supra-orbital ridge in the bone flap instead of removing it as a separate piece and reflects the flap mesially instead of laterally. Kanavel (51), Fleming, Horrax, Penfield and Grant prefer the transfrontal extradural approach. Loyal, Davis, Keegan and Rand a transfrontal intradural approach. Naffziger has made a modification in that he reflects the scalp flap separately and turns it forward and downward so as to eliminate the supra-orbital skin incision. Otherwise it is an extradural approach. McKenzie after the reflection of a frontal osteoplastic flap makes a long incision in the dura over the convex surface of the frontal lobe so as to permit the dislocation of the frontal lobe through this opening during its elevation. He terminates the operation with a small subtemporal decompression so as to allow for postoperative cerebral oedema. The approach to the chiasm is extradural. Among British surgeons Sargent uses a transfrontal approach similar to that of Frazier. The few reports from continental surgeons fail to show any noteworthy contributions.

Lateral frontal approach. Under frontal approaches it was stated that Krause was the first to suggest a transfrontal extradural approach and that he later substituted for this procedure a frontal intradural approach.

Krause suggested in his early publication that an oblique approach to the chiasm is preferable to a directly anterior approach. Krause (61) seems also to have used a lateral frontal intradural approach to the hypophyseal region for such an operation is clearly illustrated in his textbook of surgical operations. I have been unable to find any reference to this operation in the literature and do not know when it was used. As pictured it consisted in the reflection of a large osteoplastic flap over the frontoparietal region with the wide opening of the dura. The hypophyseal region was approached from the

side rather than from directly in front (Figs 16 and 17). Certainly one case with signs of acromegaly was successfully operated upon by this method and was quite well 4 years after operation.

Silbermark in 1910 operated upon 50 dogs by an intracranial approach without a single death from infection. Believing that an intracranial approach to the hypophysis was desirable from the standpoint of greater exposure and diminished danger of infection he undertook to perfect an intracranial approach in man. His operation which so far as I am aware was performed only on the cadaver consists in the formation of a bilateral osteoplastic flap one over either hemisphere with the opening of the dura on either side by a crucial incision. The head is placed in the overhanging position, the frontal lobe on the side of the approach is gently elevated with a spatula and the chiasmal region is exposed. While as we now know the operation is unnecessarily radical it includes an important principle, i.e. that of cerebral dislocation of which we constantly make use and which is obtained both by the overhanging position of the head and the contralateral cranial opening. Dandy (3) in 1918 recorded a lateral frontal intradural approach to the chiasmal region which I had devised in 1914 but had not reported. Dandy's object was of course to put the operation on record during my absence in France.

Adson also in 1918 described a lateral frontal intradural approach. An osteoplastic flap with its pedicle below is reflected downward from the temporoparietal region and the dura is opened widely. The frontal and temporal lobes are protected with rubber tissue, the base of the frontal lobe is carefully elevated from the side and the elevation is continued until the optic nerves and chiasm come into view. If the hypophyseal tumor presents anteriorly between the optic nerves it is freed encircled by a tonsil snare and removed.

Heuer in 1906 gave a more detailed account of the operation described by Dandy in 1918. A large osteoplastic flap is reflected downward from the frontotemporoparietal region and a dural flap of almost equal size is reflected posteriorly. The base of the frontal lobe is carefully elevated until the optic nerves and chiasm are brought into view. The temporal lobe is often retracted posteriorly to increase the exposure (Figs 18, 19, 20). The approach is therefore a lateral intradural approach and in all respects resembles the operation of Adson excepting that the bone flap is larger. The purpose of a large flap is to allow for cerebral dislocation. The overhanging position of the head combined with ventricular puncture still further increases the ease and extent of the exposure. More recently a small subtemporal decompression has often been added to the procedure in order to take care of the possible postoperative cerebral oedema. This operation has now been used by him in 40 consecutive cases of hypophyseal, chiasmal and suprasellar tumor.

Bakulew in 1926 in a discussion of the value of various approaches to the chiasmal region states

that the frontal extradural approaches of Krause, McArthur and Frazier fail to give sufficient exposure and that Adson's parietotemporal approach is fairly satisfactory in dolichocephalic but difficult in brachiocephalic heads. He states further that it is attended with the possibility of injury to important vessels in the approach to the sella and gives only a limited exposure of the chiasmal region. Because of these objections to the extradural and Adson's intradural approaches he suggests the reflection of a large frontoparietotemporal osteoplastic flap, the reflection of an equally large dural flap and the intradural approach to the chiasm from the side. He does not give any illustrations of his procedure but from his description his operation resembles exactly that which I described in 1920. He thinks that this operation secures a wider exposure than others with which he is familiar and reports several cases operated upon by this method. His report is the only one I have been able to find since 1920 which is concerned with the lateral frontal intradural approach.

EXTRACRANIAL OPERATIONS

The purpose of all extracranial operations has been to approach the floor of the sella turcica through the sphenoidal sinus. They may be roughly grouped into nasal and buccal operations, the former of which may again be divided into superior nasal (Giordano, Schloffer, Eiselsberg, Kocher, Kocher, etc.) and inferior nasal (Kannell, Halstead, Hirsch, etc.).

The all sphenoidal operations. Giordano in 1897 proposed a transphenoidal approach which consisted of the osteoplastic resection of the anterior wall of the frontal sinus and nose. The operation was improved upon by Schloffer who in March 1907 was the first to perform a successful partial tumor removal. His operation consisted in the reflection of the nose to the right and the excision of the tubercles, the mid septum, the wall of the orbit and maxillary sinus, the left nasal process of the superior maxilla and the ethmoid cells. The floor of the sella was removed and the adenomatous tumor partially removed. Moszkowicz a little later in the same year suggested a modification of Schloffer's operation in which the nose was reflected to the side and the septum and the ethmoid cells removed. The inner walls of the orbit and maxillary sinus were left intact. Sufficient exposure was obtained by the removal of the anterior and lower wall of the anterior cranial fossa and a part of the frontal process of the superior maxilla. The operation was divided into two stages. After the sphenoidal sinus was opened and exposed a pedunculated skin flap from the forehead was turned back into the periorbital wound, the end of which was introduced into the sphenoidal sinus. At a second sitting the floor of the sella was entered and the tumor removed. The top of the skin flap previously turned back into

the operative opening was now used to tamponade the sella turcica. The idea of the skin flap was to lessen the risk of meningitis. Loewe (66) in 1908 reported a superior nasal approach which with very slight modifications was the same as that used by Schloffer and later by Eiselsberg, but the author suggests that Schloffer's and Eiselsberg's operations were modifications of the operation practiced by him upon the cadaver. Hochenegg simplified Schloffer's operation removing only the nasal septum and the turbinates and in 1909 reported 3 cases operated upon by his modification. Eiselsberg (28) modification (1908) of Schloffer's operation was also less extensive. A tuning fork incision consisting of a vertical incision in the mid forehead continued into two incisions, one along each side of the nose, was followed by the reflection of the nose downward, the temporary resection of the frontal sinus and the excision of the nasal cavity. Later (1910) he (29) considerably modified the method in favor of one in which the nose is deflected to the side (Figs. 1-22). Kocher in 1909 simplified the intranasal part of the operation still more. Through a skin incision T shaped above and inverted Y shaped below (Fig. 23) a submucous resection of the septum was done followed by the division of the nasal bone in the midline and the reflection to each side of an osteocutaneous flap comprising over half the nose. The mucous membrane of the septum was displaced laterally and a specially devised speculum was introduced into the nasal cavity, the opening of which crowded the mucous membrane and the turbinates to either side. An operative approach was thus obtained to the floor of the sella turcica. Kocher reports a case operated upon by this method in which he successfully performed a fragmentary removal of an hypophyseal tumor.

Among the more radical superior nasal approaches was that of Nowikoff who in 1913 proposed the temporary resection of the upper jaw and nose (Fig. 4). The turning outward of the nose and superior maxilla gives a wide approach to the base of the skull and the sphenoidal sinus is easily recognized and opened. The operation so far as I can determine was performed only on the cadaver. Among the lesser superior approaches is that of O'Chiar (1912) more recently described and used by Oebler (1922). It consisted of a short curved skin incision around the inner border of the orbit with resection of the ethmoid in other words a transethmoidalsphenoidal approach (Fig. 25). Oebler reports 6 cases operated upon successfully by this method.

The subsequent modifications of the procedures mentioned—all superior nasal approaches—were in the direction of converting them into inferior nasal approaches.

Kannell (52) in 1909 demonstrated upon the cadaver the possibility of approaching the sella turcica through the inferior nares. The nose was

turned upward by an external curved incision through the nasolabial junction of the face and an entrance was made into the inferior part of the nasal cavity. The nasal septum was cut along its inferior part and its attachment to the perpendicular plate of the ethmoid. The middle turbinates were removed and the septum deflected to one side. The sphenoidal foramina were located and the interfering attachment of the perpendicular plate of the ethmoid and the vomer were bitten away. The anterior wall of the sphenoid cells was broken into and the floor of the sella was removed. In the approach a Fraenkel nasal speculum was used to hold the deflected septum to one side and the operative manipulations within the sphenoidal sinus were carried out through the speculum. Sufficient illumination was obtained with a headlight. The following year Kanavel (53) reported a case successfully operated upon by the method as did Mixer. In 1913 Kanavel (54) reported 3 cases operated upon by his approach and reviewed the cases of hypophyseal tumor operated upon by the nasal route reported in the literature. In 1918 Kanavel (55) reported the late results in his cases and gave some excellent drawings to show his approach (Figs 26 27 28 29).

In the same year (1909) Hirsch (41) suggested an endonasal route done in two or three stages under local anesthesia. The operation consisted in the resection of the median septum and the subsequent opening of the sphenoid through a single nostril after the method of Hajek. In 1910 Hirsch (42) reported a case operated upon successfully by this method. As a result of his experiences with this case he (43) suggested (1911) a median approach with resection of the septum as being better than a lateral approach through one nostril and he reports 11 cases operated upon by this method. In 1912 Hirsch (44) was able to report 26 cases and in 1926 (47) 100 cases operated upon by his endonasal approach. West suggested a similar procedure at about the same time.

In 1910 A. E. Halstead (38) impressed by the advantages of Kanavel's infranasal route adopted it in his first operative case but modified it by using a sublabial instead of an infranasal incision. After a preliminary tracheotomy the upper lip was raised and an incision was made in the mucous membrane over and parallel with the alveolar process just below the labial frenum. The soft tissues were freed from the underlying bone and the nose was gradually drawn upward with retractors. The septum was divided with bone forceps and displaced upward and laterally. The turbinates vomer and perpendicular plate of the ethmoid were removed. The anterior wall of the sphenoidal sinus was opened and there presented in the sphenoidal sinus a bluish pulsating tumor. This was partially removed. A second case was operated upon by the same method.

Cushing (15) in 1912 after using Hochenegg's and Eiselsberg's modification of Schloffer's operation evolved an approach which was a modification of

the methods of Kanavel Halstead and Hirsch. The upper lip was drawn up and an incision was made across the labial frenum according to the method of Halstead. The incision was carried down to the anterior nasal spine of the superior maxilla and by blunt dissection the soft parts were separated from the lower margin of the bony nasal opening until the cartilaginous septum was exposed. The mucosa was elevated from the bony and cartilaginous septum. With a retractor holding the mucous membrane to either side the septum was removed together with most of the vomer and part of the median plate of the ethmoid and occasionally the anterior spine of the maxilla. With the original retractors in place a series of dilating plugs were introduced between them the object of which was to flatten the turbinates to one side. A bivalve speculum was then introduced to replace the retractors and working through this with the aid of a headlight the sphenoidal sinuses were identified. The sphenoidal cells were opened with nasal rongeurs and the lining mucous membrane was removed. The protruding floor of the sella was then identified perforated and removed with rongeurs. The capsule of the hypophysis was opened and the cystic contents were evacuated or the tumor tissue removed. A recent personal communication states that Cushing has performed 280 transphenoidal operations according to this method undoubtedly the largest single series by any method (Figs 30 31 32 33 34).

There have not been any further important contributions to this operative approach. The literature on the subject is very large and numerous slight modifications from time to time have been suggested. To detail them would be to prolong unduly this part of our discussion without making any noteworthy contributions to it. Essentially they are all inferior nasal approaches.

The buccal transphenoidal operations. As is the case in many of the operations just described the buccal transphenoidal operations have now only an historical interest.

Koenig in 1900 after an investigation of years on the cadaver reported a transpalatal approach to the hypophysis. The operation consisted in the division of the soft palate in the midline the reflection of the mucosa and periosteum from the hard palate and the resection of the hard palate according to the method of Gussenbauer. The entrance into the nasal cavity thus obtained was followed by the removal of the nasal septum and vomer and the exposure of the hypophysis through the sphenoid. I cannot find that Koenig practiced this operation upon the living subject but Stewart and Ballance successfully exposed any hypophyseal tumor by this route and Durant and Freysing are said to have used it. As late as 1913 Broeckart favored this approach. Loewe (67) in 1900 described his method which also consisted of an ap

proach through the palate but according to the method of Partsch instead of according to that of Gussenbauer Krogus in 1909 also suggested a transpalatal approach after dividing the lower jaw in the middle Bichl in 1912 proposed as a preliminary step in the transpalatal approach a suprahyoid pharyngotomy At the time of his report he had practiced this approach only on the cadaver

Such in resume are perhaps the most important of the many surgical approaches to the chiasmal region Their evolution forms an interesting chapter in the history of operative surgery While the intracranial approach was the first in the field neither the operations of Caton and Paul of Krause of Juhant or of Bogojavlensky proved successful in the hands of surgeons untrained in neurologic surgery Only Horsley who was so trained achieved any measure of success and his record of 10 operative cases with 2 deaths remained for a long time unapproached For the rest the intracranial approach was attended either by failure to expose the lesion by massive hemorrhage or by severe injury to the brain with a resultant mortality which was in the neighborhood of 70 to 80 per cent When Schloffer in 1907 reported the first successful partial tumor removal by a transphenoidal approach it was natural that surgeons should adopt this method for while technically the transphenoidal operation is not always easy it is inherently safer from the standpoints of hemorrhage and brain injury and may more readily be performed without special knowledge of or training in neurosurgery The transphenoidal operation promptly became the operation of choice for hypophyseal tumors and through the modifications of various surgeons already mentioned evolved into the highly perfected inferior nasal sublabial approach that we know today Within 5 years after Schloffer reported his successful case Hirsch (45) was able to collect 148 operations for hypophyseal tumor 126 of which had been done by the transphenoidal route and Frazer (32) about the same time found 74 cases of hypophyseal tumor verified by operation or autopsy 64 of which had been operated upon by the transphenoidal route In the same period if we exclude the unreported cases of Horsley only 3 case of hypophyseal tumor had been successfully operated upon by an intracranial route With the passing years the number of patients operated upon by the transphenoidal method steadily mounted until in 1926 Hirsch (47) alone could report 100 cases and in 1929 Cushin (14) alone could report 280 cases

The disadvantages of the transphenoidal route rather quickly became known It was not an aseptic approach and when tabulation of cases first began to appear in the literature the mortality from meningitis alone was in some instances as high as 25 per cent It was realized that the approach was very restricted and quite failed to expose the lesion it was intended to expose it altogether failed to give the operator any idea of the intracranial extent of the lesion attacked it was wholly inadequate in the approach to lesions above the chiasm (suprasellar) and the results obtained by the operation were unsatisfactory and temporary The mortality in the earlier series of cases reported (Schnoor 148 cases by various transphenoidal methods) varied between 13 and 38 per cent with an average mortality of 25 per cent In spite of its disadvantages it continued to be the operation par excellence for hypophyseal tumors and there were surgeons who stated in the literature that it would always remain the operation of choice for primary pituitary lesions Indeed it probably was the operation of choice until 1926 and after but since that time has been largely superseded by other methods The probable reasons for its decline will shortly be stated

Meanwhile the intracranial approach received little support and it was not until 1912 that some interest in it was revived by the publication of McArthur's frontal approach McArthur like many others was impressed by the disadvantages of the transphenoidal approach and his operation was designed to overcome them and the fact that he was able to expose an hypophyseal tumor in each of 3 cases by his approach did something toward dispelling the idea that the chiasmal region was unapproachable by the intracranial route Moreover the need of an intracranial approach was becoming better appreciated for it was beginning to be recognized that the suprasellar tumors meaning by that term lesions lying above the chiasm could not be dealt with satisfactorily by the transphenoidal approach Frazer in 1913 modified and simplified McArthur's approach and his repeated modifications of his own method have resulted in a comparatively simple transfrontal intracranial approach which has stood the test of experience and has survived to the present day Perhaps no other single surgeon has done so much to popularize the intracranial approach for Frazer in his many publications on the subject has established the important facts that aside from its advantages as an aseptic approach actual experience with the two methods shows that the intracranial

approach better exposes the lesion it is intended to attack that the results obtained are more promising, and that the mortality is as low or lower than that of the transphenoidal approach. By 1916 surgical ideas regarding the approach to hypophyseal tumors had crystallized to such an extent that all the operative approaches to the chiasmal region here described had largely been abandoned excepting two—the transfrontal intracranial approach of Frazier and the inferior sublabial transphenoidal approach as developed by Kanavel Halstead Hirsch and Cushing. Of these the weight of opinion was all in favor of the transphenoidal approach for it had the support among others of Eiselsberg Kanavel Hirsch and Cushing whose combined experience and clinical material far exceeded that of others interested in this field. However with the continued advocacy of other intracranial procedures by Dandy Adson and others there began about 1920 a trend in favor of the intracranial approach which has continued to the present time. Today the weight of surgical opinion is wholly in favor of the intracranial approach to lesions about the chiasm. In an attempt to discover more accurately the present opinion among neurologic surgeons I have addressed a questionnaire to the 31 members of the Society of Neurologic Surgeons and to others whom I know are interested in neurologic surgery. Of the 21 surgeons who were kind enough to reply to my questionnaire two for various reasons failed to express a definite opinion as to a choice of operative approach. Of the 19 who expressed a positive opinion 15 are unreservedly in favor of the intracranial approach to lesions about the optic chiasm including hypophyseal tumors. This of itself is significant as indicating the recent trend in this field of surgery, but it is also interesting that no surgeons¹ who primarily or after experience with both methods advocated the intracranial approach have ever adopted or gone back to the transphenoidal approach while with only one or two exceptions those who have been instrumental in the development of the transphenoidal approach and who for years have advocated this method have finally abandoned it in favor of the intracranial approach. The change in attitude in some instances has been sudden for we find that authors who strongly advocated the transphenoidal approach 4 years ago now declare it to be obsolete. Of the 4 neurologic surgeons who were not unreservedly in favor of the intracranial approach 3 favor the transphenoidal approach for hypophyseal tumors eroding the base of the sella and the

clinoid processes the transfrontal approach for suprasellar tumors or for the larger intrasellar tumors or for those primary intrasellar growths which have recurred after a transphenoidal approach and 1 favors the transphenoidal approach for pituitary tumors with acromegaly. The transfrontal for all other lesions. From foreign literature if I have interpreted it correctly there has been a similar trend toward the intracranial route. The notable exceptions are Hirsch (47) whose latest report appeared in 1926 and Krause (62) (1927) who although the first to suggest the transfrontal approach has adopted the Schloffer operation as the operation of choice.

It is interesting to try to trace the reasons for this change in attitude. I noted in preceding pages that the intracranial approach when first attempted was attended by a mortality of 70 to 80 per cent and that one reason for this prohibitive mortality was the unfamiliarity of surgeons with intracranial procedures. The mortality however was really no greater than that following attempts to remove brain tumors generally when the attempts were made by surgeons untrained in neurologic surgery. Under these circumstances the transphenoidal approach promised and did actually show far better mortality results even though it carried the real danger of meningitis. With the development of neurologic surgery as a more or less special field of surgery and with the training of surgeons in this special field the mortality attending all operations upon the brain declined as it did in operations for hypophyseal tumors. In 1916 Cope collected the cases of pituitary tumor operated upon by various methods and found that the mortality following the transphenoidal approach was 9 per cent that following the intracranial method (fronto orbital) was 8.6 per cent. In 1919 Frazier (33) added 8 cases without a death reducing the mortality of the intracranial approach to 6.4 per cent. By 1920 then the mortality attending the transphenoidal and intracranial approaches was practically the same. In our report of 1920 we had to confess to a much higher mortality (37 per cent) following a lateral intradural intracranial route. Before the report was published however, we had proved to ourselves that our mortality was due not to the method of approach but to the attempt to deal too radically with the lesions exposed and our mortality since 1920 (6.6 per cent) would tend to bear out this statement. At the present time the mortality generally throughout the country in the hands of neurologic surgeons may be gathered from the report of 14 neurologic surgeons who are willing to submit their figures

In 351 cases operated upon by 7 surgeons by the transphenoidal route there were 24 deaths a mortality of 6.8 per cent in 39 cases operated upon by 13 surgeons by the intracranial route there were 29 deaths a mortality of 12.5 per cent. These figures would appear to indicate that the mortality following the intracranial route is generally higher than that following the transphenoidal route but a study of the data at hand shows that this is not the case. From the reports of 14 neurologic surgeons we find that 7 had not operated by the transphenoidal route at all and of the 7 who had used this route 1 surgeon whose mortality was very low had operated upon 80 per cent of all the cases. On the other hand all of the 14 surgeons had used the intracranial route and with a more widely distributed and therefore a higher mortality. A comparison of the mortality of individual surgeons who had used both type of operation shows that it is approximately the same if anything somewhat lower following the intracranial approach.

While the reduction in the mortality of the intracranial approach has been a factor in shaping the trend of opinion in favor of the intracranial route it would not appear to have been the important factor for surgeons with the widest experience in the surgery of hypophyseal lesions continued to advocate the transphenoidal route long after the mortality of the two operations was the same. More important perhaps was a growing belief in the minds of many that the results following the transphenoidal approach were unsatisfactory. How unsatisfactory they have been has never yet been made clear for the reports of the results obtained which have appeared in the literature have been so vague as to make an accurate estimate impossible. From a tabulation in Cushing's monograph (15, 1912) we find that of 32 cases in which a transphenoidal operation was done 8 were greatly improved some with restoration of vision 15 are called improved some only temporarily 5 were not improved 4 died. In a later report of 68 cases (1914) 61 of which survived operation Cushing (16) found that in 22 cases progressively failing vision had become stationary or had been slightly improved for a few months to several years in 22 cases there was a prompt widening of the visual fields with marked improvement in vision in 2 cases the vision was made worse but later it improved in 5 cases in which vision was lost there was a partial return in 8 cases there was no improvement at all and in 3 cases there was progressive failure of vision in spite of a successful operation. Still later (1922) he (17) reported

that the immediate results in 154 cases of adenoma operated upon by the transphenoidal route showed an improvement of vision and widening of the visual fields in 50 per cent a remarkable improvement with retardation of the disease in 20 per cent and a failure of improvement in 20 per cent. He found that it was more difficult to give an exact idea of the late results for as he rightly states they depend upon many factors. But it is evident that 75 to 80 per cent of the cases which survived operation failed to regain useful vision for any length of time and had recurrences or died within 2 years of operation while 20 to 25 per cent had preserved useful vision for 5 years and sometimes for 10 years. Since 1922 I have been unable to find any reports of late results from Cushing's clinic. His then associates Dott and Bailey in 1926 reported upon the pathological anatomy clinical aspects symptomatology diagnosis and treatment of 162 cases of hypophyseal adenoma but failed to include the results of treatment. It is evident from their paper that the transphenoidal approach remained as late as 1926 the operation of choice for hypophyseal adenomata. Hirsch (44) in 1912 reported upon 26 cases operated upon by his endonasal method and found that 12 with visual disturbances were improved but of these only 2 were considerably improved for 1 year 3 were slightly improved 1 to 2 years 7 were slightly improved for less than a year while 8 were not improved at all 3 died. In a later report (1914) upon 37 cases he (46) find that 21 were improved over long periods of time but gives no statement of the time or the quality of the improvement 5 were improved for 2 to 6 months followed by a return of symptoms 4 were unimproved and 5 died. In 1926 he (47) reported upon 100 cases operated upon by the endonasal approach but unfortunately failed to give any results.

I shall not go farther in a citation of statistical results for to do so would not elucidate the subject. I have pretty thoroughly covered the literature of the subject since 1900 and it becomes evident that a collection of small series and scattered single reports does not improve the results naturally it rather makes them worse. The adenomata the adenomatous cysts and other intrasellar cysts being the only lesions from which results could be expected by the transphenoidal approach the results of Cushing and Hirsch which I have just quoted would seem the best that could be hoped for by this operation alone. That it brings only temporary relief in the large proportion of cases that it is followed by rather prompt

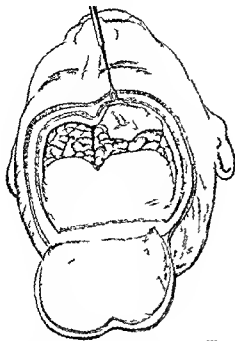


Fig 2 The approach to the hypophysis suggested by Kiliani (Ann Surg 1904 xl 35)

recurrence of symptoms and that it fails to prevent the intracranial extension of hypophyseal tumors (adenomata) has been the opinion of many for over 10 years

To attempt to compare the results of the transphenoidal operation with those of the intracranial operation (transfrontal or lateral frontal) at the present time is almost futile. The results obtained by the intracranial approach as reported in the literature are as meager and indefinite as those of the transphenoidal route. Moreover in the reports of intracranial operations the many lesions met with by this route are often not specifically designated so that comparisons are difficult. It would of course be ridiculous to compare the results obtained from operations for adenomata of the hypophysis by the transphenoidal route with those from operations for cranio-pharyngeal duct tumors by the intracranial route and the only comparison of results which fairly can be made by the two methods is that of operations for pituitary adenomata. Data allowing such a comparison are not yet available in the literature. Neither Cushing nor Frazier nor others who have had a large experience with both methods have as yet reported comparative results. In 1920 I reported a series of cases operated upon by an intracranial route among which were 7 cases of adenomata which survived the primary operation and in my Cincinnati series are 8 additional cases. Of the 15 cases of adenomata operated upon by my lateral frontal approach 2



Fig 3 McArthur's approach showing the outline of the skin incision (Surg Clin 1918 xi 691 699)

at last report had excellent vision and were free from any signs of recurrence 5 years after a second operation (both had secondary operations for recurrence at 2 years and 1 year respectively). 5 have excellent or normal vision without signs of recurrence (except possibly 1) over 2 and up to 3 years after operation and 3 have good to normal vision and no signs of recurrence from 1 to 2 years after operation. Five died from 4 months to 2 years presumably from recurrence and 1 (known to be living until recently operation February, 1923) has not reported. The series as will be seen is still too small nor has sufficient time elapsed to draw conclusions but such as it is it promises better than the available results of the transphenoidal route. We must finally come down to the statements of surgeons rather than their published reports and I find in writing to the various members of the Society of Neurologic Surgeons that men who have had the largest experience with both methods of approach (Cushing, Frazier and others) now state that they are getting better and more permanent results with the intracranial than with the transphenoidal approach.

If we accept the opinions expressed what is the possible explanation for the improved results following operations for adenomata by the intracranial route—understanding by improved results the most important results that any surgical procedure has achieved i.e. the improvement in and the preservation of vision? It will be recalled that for many years the supporters of the transphenoidal route made certain claims for it i.e. that by a sellar decompression it best met the indication of persistent and severe sellar headaches that it was the ideal method for the evacuation of intrasellar cysts whether adenomatous or derived from Rathke's pouch and that it would probably always remain the operation of choice for intrasellar solid adenomata which had not yet extended widely into the intracranial space. In

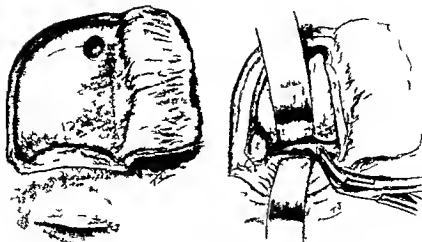


Fig. 4. Left McArthur's procedure. The bone is moved which has been placed in the floor of the sella.

the last group of cases (the solid adenomata) it was argued that the opening of the dural capsule through the sellar floor permitted the downward dislocation of the tumor thereby preventing or relieving pressure of the tumor upon the chiasm and that it allowed the tumor to grow downward into the sphenoidal sinus rather than upward into the intracranial space because it did not like the intracranial approach interfere with the natural barrier to upward growth, i.e. the tentorium sellae or sellar diaphragm. As late as 1926 Dott and Bailey supported these views and I find that a few of the neurologic surgeons still support them today.

When one attempts to discover the basis of these views he finds little to support any of them. Such reports as are available in the literature and our own experience with cases treated elsewhere by a sellar decompression would indicate that relief of headaches if obtained in solid adenoma is but temporary—so temporary as scarcely to warrant the operation done for their relief. On the other hand our own experience make it appear certain that by the intracranial approach with the partial removal of the tumor the headaches are more permanently relieved. So far as I can determine only one group of cases, those with acromegaly and sellar headaches but with

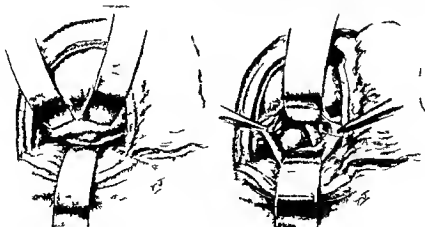


Fig. 6. Left McArthur's procedure. The bone is moved which has been placed in the floor of the sella.

Fig. 7. McArthur's procedure. The bone is moved which has been placed in the floor of the sella.

out visual disturbances might conceivably better be treated by the transphenoidal approach and these not because the relief of headache is more certain or more permanent but because the transphenoidal approach is probably safer for it is true that the intracranial operation in acromegals is prone to the complication of postoperative clot. But even in this group of cases it is probable that X-ray therapy will better meet the indications than will a sellar decompression a matter which I shall subsequently discuss. Nor is there any suggestion of proof in the literature that the intrasellar cysts whether adenomatous or derived from Rathke's pouch or the solid adenomata may be better treated by the transphenoidal than by the intracranial approach. The idea that they could seem based upon the supposition that the sellar diaphragm prevented the upward growth of these lesions and that they were therefore inaccessible by the intracranial approach until very late in the disease. This idea was seriously questioned by Cope in 1916. He showed by anatomical studies that between the sellar diaphragm and the optic chiasm lies a large subarachnoid space the cisterna basalis so that these two structures are separated from each other a distance of 1 centimeter and he stated that any cyst or tumor arising within the sella turcica would have to protrude well upward into the intracranial space before it could exert pressure upon the optic nerves or chiasm. All available autopsy records of deaths following operation have supported his view for a majority of all

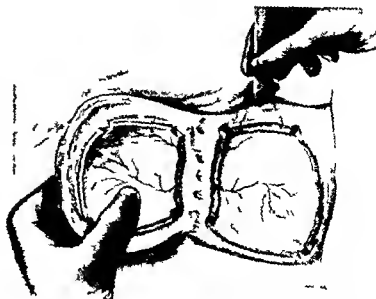


Fig 9. Frazier's transfrontal approach showing reflection of osteoplastic flap and outline of portion of supra-orbital ridge removed.

patients with pituitary tumor who die after operation show an intracranial extension of varying size. Moreover in 1920 we reported that we had found by the consistent use of an intracranial approach that every pituitary tumor or cyst associated with visual disturbances had at operation extended well into the intracranial space so that we felt we could state that every pituitary lesion presenting visual disturbances was of necessity an intracranial lesion. Our experience since that time has invariably supported this view.



Fig 8



Fig 10

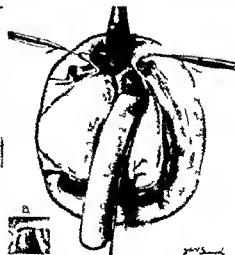


Fig 11

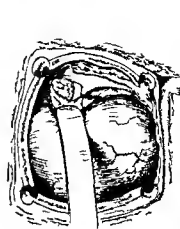
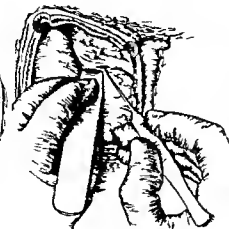
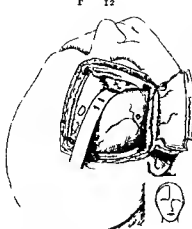
Fig 8. The transfrontal approach of Frazier showing the incision in the scalp (Surg., Gynec. & Obst. 1919, vol. 9).

Fig 10. Frazier's transfrontal approach. The dural flap has been reflected. A dural incision is carried down

ward and back and over the roof of the orbit so as to facilitate the exposure of the hypophysis.

Fig 11. Frazier's transfrontal approach. The frontal lobe is elevated and the hypophyseal tumor and optic nerves are brought into view.

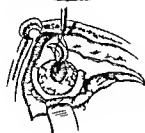
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F 15

The sellar diaphragm therefore does not prevent the upward or intracranial extension of pituitary lesions nor does it as is shown by the 80 per cent recurrences following the transphenoidal operation after the floor of the sella turcica has been removed.

Since these facts were established there has been nothing to support the contention that the adenomata the cystic adenomata and cysts are more accessible by the transphenoidal route for they all when they have produced visual disturbances (the important operative indication) project into the intracranial space and therefore are accessible by the intracranial route. Not only are they accessible but their size their extension and their relationships to important surrounding structures may be determined. Through a process of reasoning at present obscure it was argued by many in the literature that it was preferable in dealing with pituitary lesions to remove a portion of the lesion remote from the optic chiasm rather than that portion directly impinging upon the chiasm. The advantage of the intracranial approach is that it permits precisely this—the removal of that part of the lesion which directly compresses the chiasm and this we believe is the reason for the improved results following the

intracranial method. The statement applies particularly to the solid adenomata but it is probable that the wider excision of the walls of adenomatous and other cysts made possible by the intracranial method has contributed to the longer period of freedom from recurrence.

Perhaps another factor of considerable importance in determining the trend of opinion in favor of the intracranial approach has been the growing appreciation of the variety of lesions about the optic chiasm amenable to surgical treatment. The impetus responsible for the development of surgical approaches to the chiasmal region was the recognition by Marie and Marinesco and by Babinski and Froehlich of the association of pituitary tumor with the clinical pictures of acromegaly and dystrophia adiposa genitalis and surgical approaches to the chiasmal region were primarily developed with the sole purpose of attacking pituitary tumors. For a considerable period of time they were the chief concern of the surgeon and it was natural that his ingenuity should have been directed toward the perfection of approaches such as the transphenoidal approach which permitted him most safely to attack them. But it became apparent that other lesions about the chiasm may cause visual disturbances

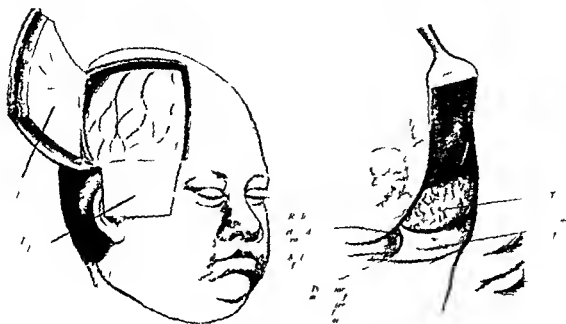


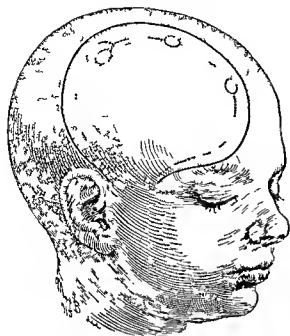
Fig. 16. Krause's lateral frontal approach showing the position of the osteoplastic flap.



Fig. 17. Krause's lateral frontal approach showing the exposure of the chiasmal region.

and sometimes the glandular symptoms and sellar abnormalities of pituitary tumors and gradually—and it is to be emphasized chiefly through the use of the intracranial approach—a whole series of pathological conditions about the optic chiasm have come to be recognized. I have not made an effort to determine when and by whom the first suprasellar craniopharyngeal duct tumor was clinically recognized and subjected to operation, but it was one of the early lesions which called attention to the fact that there were con-

ditions about the chiasm other than intrasellar pituitary tumors which required surgical therapy. Gradually a number of lesions diverse in their pathology but clinically similar in that they all cause visual disturbances has come within the sphere of the neurologic surgeon: the craniopharyngeal duct tumors which may be intrasellar but are usually suprasellar; the cholesteatomata, the dermoids and teratomata; the gliomata arising from or about the infundibulum; the gliomata of the optic nerves and chiasm; the meningiomata



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arising from the tuberculum sellæ and other similar tumors as the parasellar prechiasmal and posterior olfactory groove tumors the suprasellar adenomata and the occasional aneurisms. In addition to these—with the exception of the occasional aneurism all tumors—is at least one non-tumorous condition which like the tumors may cause visual disturbances the so called chronic cysternal arachnoiditis 4 cases of which we have subjected to operation in the past 2 years and with results thus far eminently satisfactory. That other conditions may be brought to light as soon as the ophthalmologists consider the surgical possibilities in the group of cases now more or less indiscriminatively included under the term primary optic atrophy seems more than likely.

From a consideration of this variety of lesions about the optic chiasm it becomes apparent how greatly previous conceptions have of necessity changed. The earlier reports of hypophyseal surgery are concerned with the improvement in the acromegalic or other so called glandular symptoms but we have learned that these may be but slightly affected by surgery. We are now more concerned with the visual disturbances caused by a variety of conditions of which pituitary tumors are merely one. They with the exception of the intrasellar pituitary adenomata and cysts are all suprasellar tumors accessible only by an intracranial approach and since as we have attempted

to show the intrasellar adenomata and cysts may also more advantageously be treated through this approach the transphenoidal operation has now practically become obsolete.

Our present attitude then with reference to the surgery of the chiasmal region is that we must be prepared to meet and to deal not with a single group of tumors but with a variety of pathological conditions which cause optic atrophy and serious visual disturbances. Clinically some of these lesions (pituitary adenomata cystic adenomata intrasellar cysts some of the cranio-pharyngiomata etc.) may be associated with sellar deformities hemianopsias and glandular derangements as indicated by acromegaly and dystrophia adiposa genitalis others (cranio-pharyngiomata suprasellar meningiomata suprasellar adenomata gliomata of the chiasm etc.) may be associated with visual field defects alone (usually bitemporal) and quite in the absence either of abnormalities of the sella turcica or of derangements of internal secretion while still others (cisternal arachnoiditis) may present simply optic atrophy and loss of vision without even (although they may present) characteristic visual field defects. The symptoms common to them all are optic atrophy and loss of vision and surgically our chief concern regardless of other symptoms which may be present is the preservation or the restoration of vision. In the exposure of these various lesions the intracranial approach alone suffices for it brings them all into view so that their pathology their extent and their involvement of neighboring structures may be appreciated and properly interpreted with respect to surgical treatment. Whether this intracranial approach should be the transfrontal as devised by Frazier and adopted and modified by Cushing and others or the lateral frontal as devised by me and adopted and modified by Adams and Dandy and others may well be left to the individual surgeon for both with equal safety and with few complications apparently give sufficient exposure to recognize and deal with lesions about the chiasm. One complication attending the transfrontal approach which has not yet so far as I am aware been noted in the lateral frontal approach is a disturbing and sometimes alarming fall in blood pressure during the elevation of the frontal lobe directly from in front. Frazier (34) has called attention to this and has therefore more recently and without thus far observing this complication elevated the frontal lobe from the side as we do in our lateral frontal approach. Cushing (20) although he does not comment upon it has described a similar fall in blood pressure.



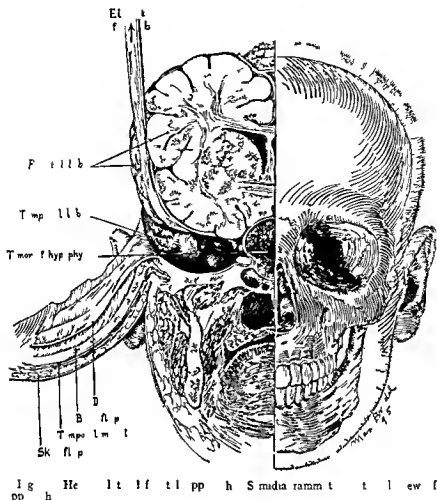
FIG. 19. Heuer's lateral frontal approach showing the exposure of the hypophyseal tumor and optic nerve.

TYPES OF TUMORS

After a period of more than 20 years having arrived at some unanimity of opinion regarding the proper approach to lesions about the optic chiasm but having only in recent years and largely through this approach appreciated the variety of lesions which may cause visual disturbances it is but natural that their treatment cannot yet be considered settled. Indeed one might say that only now are we in position to gain more accurate information regarding the treatment and the results of treatment of lesions

about the chiasm for since as we have noted the majority of surgeons interested in this field have come to realize the necessity of their proper exposure the entire clinical material rather than a small fraction of it as heretofore will become available for accurate study. Nevertheless some advances have been made and we may set forth the present ideas regarding the treatment of the various lesions which we have discussed.

1. *The chromophil adenomata associated with acromegaly.* In the treatment of chromophil adenomata associated with acromegaly there are 3 phases of the condition which come up for con-



sideration (1) the possibility of bringing about a recession of the condition of acromegaly or of halting its progress so as to prevent the late and often fatal manifestations of cardiac and other visceral enlargement and tissue hypertrophies (2) the relief of the often severe sellar head aches and (3) the prevention of visual disturbances or the checking of their progress if present or the restoration of vision. One of the difficulties confronting us in this as in other forms of hypophyseal adenoma is that we know practically nothing regarding the factors which control its life history. It has been an experience common to many that acromegaly is a condition subject to remissions or one which reaches a certain stage in its development and then becomes more or less stationary. It may then not progress beyond a certain stage or may not for many years if ever reach its late stages. Headaches present in the early stages of its development may sponta-

neously disappear and not recur. Visual disturbances may never appear or if present may become stationary. If we ascribe the symptoms of acromegaly to the chromophil adenoma then the clinical data indicate that the tumor in some cases is subject to alternate periods of growth and retardation in growth or may reach a certain stage in its development and become stationary. Similar clinical data indicate that the chromophobe adenomata associated with Froehlich's disease are likewise subject to variations in their growth and also may become stationary. It is difficult then to know in the earlier stages of acromegaly how to proceed and if we do institute some form of therapy how correctly to interpret the results of our therapy for it must be certain that some if not many of the brilliant late results of our surgery in pituitary adenomata are nature's results not ours. These variations in the growth and therefore the clinical manifestations

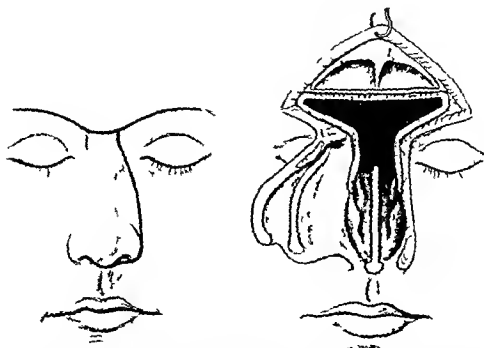


Fig. 21 (left) Eiselsberg's superior nasal transphenoidal approach showing outline of incision (Ann Surg 1910 lxv 1)

Fig. 22 Eiselsberg's superior nasal transphenoidal approach showing the nose reflected to one side and the superior nares exposed

of pituitary adenomata are however not peculiar to these tumors and it would seem quite as legitimate in these as in tumors elsewhere to try to influence the course of the disease. Two groups of cases may be discussed (a) a group with advancing acromegaly and sellar headaches but



Fig. 23 Kocher's superior nasal transphenoidal approach (a) b straight lines indicate the skin incisions the c y line the additional incisions through the bone (Dtsch Ztschr f Chir 1909 c 13)

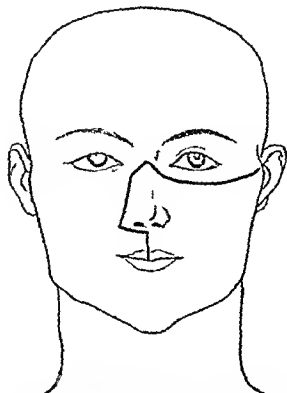


Fig. 24 Nowikoff's transphenoidal approach involving temporary resection of the superior maxilla (Cent albl f Chir 1913 xl 1001)

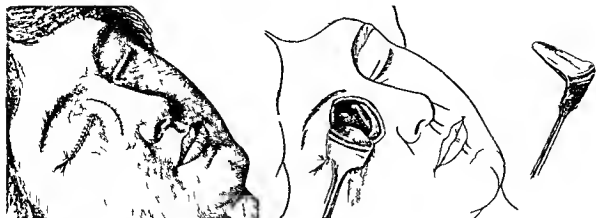


Fig 5 Ch st ph d l p p o h (Ar h f l n Ch p c 40)

without visual disturbances and (b) a group with acromegaly and definite visual disturbances.

In the presence of advancing acromegaly with sellar headaches two methods of treatment have been and are at present available—operative and deep X-ray treatment. The former has been used in the past chiefly in the attempt to relieve the later and associated symptoms of visual disturbances but it was noted in the earliest successful case of acromegaly operated upon by the transphenoidal route (Hochenegg) and has since been noted in isolated case reports that there was following the partial removal of the adenoma a measurable recession in the size of the nose, hands and feet and a loss in weight. The number of such successful results as can be culled from the literature is not large and there has been a distinct impression that the results achieved from the standpoints of the recession of tissue overgrowth and the permanent relief of sellar headaches have not been satisfactory. In how far such operative efforts have prevented the progress of the condition cannot at present be accurately estimated. More recently (1927) Cushing (18) has again considered the matter and states that accumulated experience justifies the statement that the symptoms of acromegaly may be favorably influenced by the partial removal of the hyperplastic gland. He reports 3 cases with acromegaly in which the primary indication for operative interference was visual disturbances but in which the incidental postoperative results in 2 were a recession and an apparent checking of the acromegaly. But the interest in this paper lies rather in the consideration of the cases of progressing acromegaly with sellar headaches but without considerable enlargement of the sella turcica and without visual disturbances. In the 3 cases of this sort which the

author reports—all operated upon by the transphenoidal approach—there was a diminution in the size of the hands, a loss in weight and the relief of headaches with an apparent checking of the disease for 1 year in 2 cases and 10 months in the third. His criteria for estimating the effects of the operation were the changes in the size and weight in the basal metabolic rate and in the blood sugar percentage.

The X-ray treatment of pituitary adenomata has gradually grown in favor. To Bieler due the credit for placing this method of treatment on a firm foundation and since his original publications it has been used by a constantly increasing number of observers. Kueperle and von Szily in 1926 collected from the literature 73 cases of hypophyseal tumor treated by X-ray therapy, 22 of which were associated with acromegaly. Of the 22 cases they find that 17 were markedly influenced. Not only was the condition often apparently arrested but in some cases there was a recession in the condition. In practically all the 22 cases the headaches were improved or entirely relieved. The visual disturbances were also favorably influenced in that there was improvement in their headaches and visual disturbances. In only 1 case is a recurrence of symptoms noted. Dott and Bailey record 53 cases of pituitary adenoma from Cushing's Clinic in which between 4 and 8 series of X-ray treatments were given and they conclude that the growth of the tumor may usually be retarded and an actual reduction in its size sometimes effected. But they fail to state specifically the results in tumors with acromegaly and with Froehlich's disease respectively. They call attention to the dangers in the treatment such as aggravation of the headache



Fig 26 Kanavel's inferior nasal transphenoidal approach showing the skin incision (Surg Gynec & Obst 1918 xxv 61)

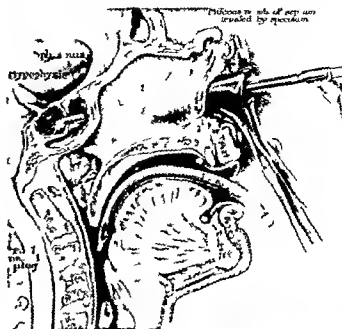


Fig 29 Sectional view of transphenoidal approach

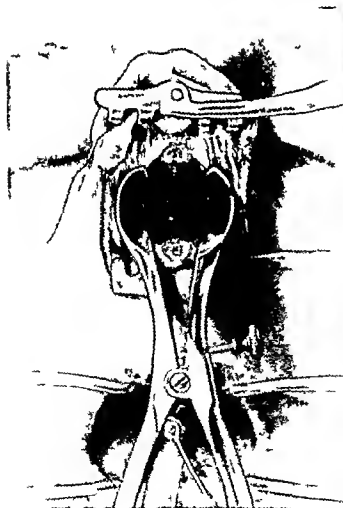


Fig 27 Kanavel's transphenoidal approach The nose reflected upward and the speculum is in position



Fig 28 Kanavel's transphenoidal approach showing the position of the patient the use of a headlight etc



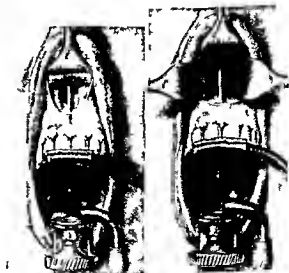
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and visual disturbances. In another paper Bailey states as his opinion that X ray treatments may be tried provided the patient is not in imminent danger of losing his eyesight that the visual fields can be carefully followed and that the patient can be operated upon if vision continues to decline. In a recent personal communication Bailey writes that thus far in his Chicago experience he has not operated upon any of the 6 cases of pituitary adenoma which have come under his observation. Two were cases with acromegaly which promptly improved with X ray therapy, while 4 were chromophobe adenomata (1 blind) which remained stationary under X ray therapy. To me among others has recently reported upon the subject and records 4 cases (presumably chromophobe adenomata) all of which have been most satisfactorily treated by X ray.

It would appear then from such data which are at present available that the group of cases with advancing acromegaly and sellar headaches but without visual disturbances may quite justifiably first be treated by X ray therapy and if this fails to check the progress of the disease or

relieve the sellar headaches surgery with the partial removal of the gland may be considered. It has been stressed that the technique of application of the X rays is important and the technique of Beclere Sosman and others should at least be familiar to those who undertake this treatment. The failure to apply the treatments properly may explain some of the negative results obtained. But it is certain that in spite of the enthusiasm of a few observers X ray therapy will fail in some cases as it has in other conditions. Moreover it should be given only with the approval and guidance of the neurologic surgeon.

In the group of cases with acromegaly and with definite visual disturbances our viewpoint with regard to treatment is slightly different. While we may hope to diminish or check the signs and symptoms of acromegaly our chief concern is the preservation or restoration of vision. It is a nice question in judgment whether to proceed at once to operation removing that portion of the adenoma which compresses the chiasm and optic nerves or to resort primarily to X ray treatments holding operative treatment in reserve should it become necessary. It is apparent that at the present time no general rules can be formulated. If vision is but slightly affected X ray treatments may quite justifiably be tried if almost lost it may appear unwise to risk the hazard of X ray treatments and proceed at once



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to operation. Our personal experience in this group of cases is very limited and we have thought it advisable to operate primarily on such cases as have come under our observation. But from the results reported in the literature vision has been improved or the decline of vision checked in a small but increasing number of cases. But the experience as far as it goes indicates as I wish again to emphasize that the symptoms in certain cases may not be favorably influenced by X-ray treatments and progress or that they may be checked or improved for a time and then recur and progress in spite of further treatments. Whether in the former instance the lesion is a cyst unaffected by X-ray therapy or in the latter and because of the X-ray treatments has become a cyst due to the degeneration of a previously solid adenoma is not yet clearly proved but is suggested by a few observations. The dangers in the indiscriminate and improperly checked use of X-ray therapy in this group of cases are very real and this method requires the closest co-operation of the ophthalmologist, roentgenologist and neurologic surgeon, the last of whom should be prepared to operate at once if vision suddenly or otherwise declines.

2. *The chromophobe adenomata associated or not with Froehlich's disease*

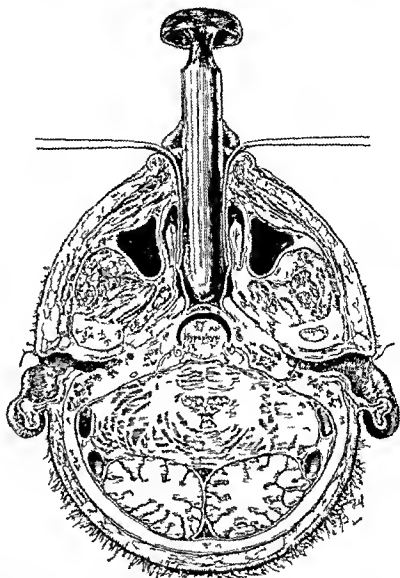


Fig. 33. Cushing's transphenoidal approach. To show the flattening of the turbinates to either side by metal plates. The septum has been removed.

Chromophobe adenomata as is well known may be associated with Froehlich's syndrome or may occur in the total absence of clinical manifestations of glandular derangement. In comparison with the preceding group of cases we have less evidence that an attack upon the tumor influences if they are present the various metabolic and sexual abnormalities included under hypopituitarism although it is of course true that the menses may for a time reappear after a period of amenorrhoea. We might expect from our experience with the thyroid—in which we observe at times following the removal of a large cyst or calcified adenoma a rise in the previously abnormally low basal metabolic rate and an improvement in the symptoms of hypothyroidism—that the removal of a tumor would perhaps relieve the pressure upon

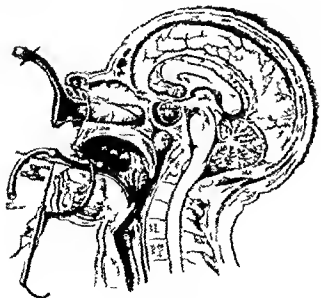


Fig. 34. Cushing's transphenoidal approach. Sectional

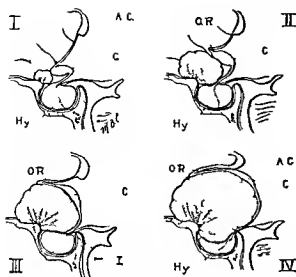


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such normal cells as may be present and so allow them to function more normally or that X rays would achieve the same object. Thus far in our experience however we have aside from the re appearance of the menses which usually has not been permanent failed to observe any noteworthy changes in the adiposity basal metabolic rate or sugar tolerance. Our chief concern at the present time is then the preservation or restoration of vision and exactly the same questions arise with regard to X ray and operative treatment which we have just discussed in connection with the chromophil adenomata associated with acromegaly and visual disturbances. That the chromophobe like the chromophil adenomata respond favorably to X ray therapy is indicated by a slowly accumulating experience. In the series of 73 cases of pituitary tumor previously noted (64) there were 16 cases of chromophobe adenoma associated with dystrophia adiposa genitalis and 34 cases without symptoms of Froehlich's disease. Of the 16 cases with Froehlich's disease practically all showed a considerable improvement in vision. But in only 6 cases was there any improvement in the symptoms of Froehlich's disease and in none a return of the sexual function. In 18 of the 34 cases without symptoms of Froehlich's disease there was great improvement in vision in 14 cases only a slight improvement or a checking of the loss of vision. Bailey and Towne as I noted under the discussion of the chromophil adenomata have had favorable results in the improvement of vision or in checking its further

loss. My own experience in checking recurrences following operation has thus far been very satisfactory. There remains then in this group of tumors the same problem as in the preceding and in the final analysis the question of whether operation or X ray shall be the primary method of attack must be left to the judgment of the surgeon.

3. *The suprasellar adenomata.* Occasionally pituitary adenomata are found occupying a suprasellar position without first having expanded and partially destroyed the sella turcica. They therefore differ clinically from the usual chromophobe adenomata in that they give rise to visual disturbances in the absence of sellar changes and often in the absence of constitutional symptoms. They may arise from an anlage in the hypophyseal stalk above the diaphragma sellae or they may have their origin within the sella and escape through a malformed diaphragm or an abnormally large foramen diaphragmatis without having previously enlarged the sella turcica. That anatomical variations in the size of the latter opening occur is well known. The treatment of these suprasellar adenomata is naturally that of other adenomata causing visual disturbances but in view of the fact that they are prone to be confused with other suprasellar lesions which fail to deform the sella turcica they are more likely to be subjected to primary operative treatment than if their true nature were recognized.

In addition to the specific remarks which we have made regarding these three groups of tumors some general remarks applying to them all may not be inappropriate. If surgery is contemplated in the group of cases with acromegaly but without visual disturbances we leave open for the present the question whether the approach should be by the transphenoidal or intracranial route for we do not have sufficient data at present upon which to form an opinion. But in all groups with visual disturbances we believe that the intracranial exposure of the tumor with the removal of that portion which compresses the optic chiasm and nerves is the operation of choice. The introduction of postoperative X ray treatments in the three groups of cases has simplified and rendered more safe the operative treatment for while formerly we were tempted to deal radically with the lesion in the hope of preventing an early recurrence and consequently increased our mortality we are now content to remove the part of the tumor compressing the chiasm and nerves trusting to X ray therapy to prevent a recurrence. While it is not proved that this method of procedure is wholly justified repeated experiences in

which symptoms of recurrence after operation have promptly been checked by a series of X ray treatments lend support to it

4 *The pituitary adenocarcinoma (malignant adenoma)* We have at the present time too little data to formulate any special remarks regarding treatment For the present the treatment as outlined for the chromophil and chromophobe adenomata is followed

5 *The intrasellar cysts* The intrasellar cysts are those derived from the chromophil and chromophobe adenomata and the cysts derived from Rathke's pouch The heading implies that they have their origin within the sella turcica and while they may cause clinical evidences of hyperpituitarism and hypopituitarism they do not cause visual disturbances until they have extended into the intracranial cavity With regard to X ray treatment we have not yet sufficient evidence to warrant dogmatic statements The cysts derived from Rathke's pouch could scarcely be expected to respond to this form of treatment and such evidence as is available would indicate that the adenomatous cysts do not favorably respond Indeed the failure of an intrasellar lesion to respond to X ray treatments is taken by some to indicate a cyst or the failure of a lesion again to respond after it has primarily responded favorably to indicate the development of an adenomatous cyst from a previously solid adenoma Granting that a diagnosis of cyst can be made it would appear at the present time that operative treatment in those cases presenting visual disturbances is the treatment of choice The intracranial approach exposes that portion of the cyst compressing the optic chiasm and nerves and it is usually possible to remove approximately the upper or intracranial half of the cyst wall Although we have made the attempt we have never felt satisfied that we have completely removed the wall of Rathke's pouch cyst and our one apparently complete removal of an adenomatous cyst ended disastrously It is certain that too radical efforts will be attended by a far higher mortality than the more conservative partial removals and at present there is considerable doubt that greatly more will be accomplished While the conservative procedure yields very satisfactory immediate results there is a definite tendency to recurrence and as yet we do not know how to prevent it Nevertheless freedom from recurrence may continue over a period of years and in our personal experience with adenomatous cysts only one has recurred under 1 year while the remainder have remained free from recurrences for $2\frac{1}{2}$ years or longer The cysts derived from Rathke's pouch

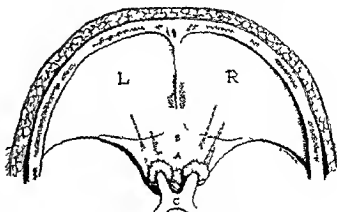


Fig. 36 Diagram of a bilateral prechiasmal intracranial tumor (endothelioma) surrounding the optic nerves (From Dandy Am J Ophth 1922 v 1)

have generally recurred earlier In the adenomatous cysts in which at operation there is found a considerable amount of adenomatous tissue postoperative X ray treatments would seem desirable for in one case of this sort in our experience a series of X ray treatments has apparently checked for a year the signs of recurrence which appeared after the primary operation

6 *The suprasellar cysts* We refer to those derived from Rathke's pouch They compress the chiasm from above and although not necessarily so may be associated with symptoms of hypopituitarism They may flatten the clinoid processes downward or fail to produce any X ray evidence of sellar deformity In quite a large percentage of cases (80 per cent in Cushing's experience) they have calcium deposits which are recognizable in the X ray plate and which are a great aid in diagnosis They vary in size and condition they may be as small as a pea or as large as a lemon they may consist of a simple thin walled cyst or a multicystic calcified or solid tumor They produce pressure upon the chiasm and cause visual disturbances and these constitute the chief indication for therapeutic measures There is no positive evidence at present that they respond to X ray therapy and operative attack is the only method we at present know of dealing with the condition The intracranial approach will expose them but their exposure is not always easy Some present anteriorly in front of the chiasm and are as readily accessible as the adenomata others present posteriorly so that the chiasm is pushed forward and downward and interposed between them and the surgeon Under the latter circumstances the lateral approach which we use has some advantages over the frontal for it is sometimes possible to dislocate the chiasm to the side and

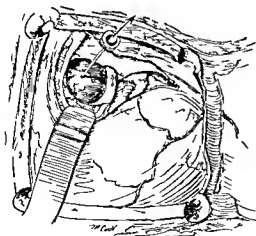


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expose the lesion making unnecessary the trans section of the optic chiasm as occasionally done by Cushing. Not only may their proper exposure be difficult but their treatment even when fairly satisfactorily exposed remains unsatisfactory. The ideal surgical procedure is their total removal but this has rarely been possible. Cushing has stated that he has been able in a number of instance apparently to dissect out completely and totally remove the lesion but this even with him must be the exceptional experience. They are invariably in our experience adherent to the optic chiasm and all of the third ventricle and attempts to remove them totally are associated with damage to the region about the third ventricle which results in an operative mortality in the neighborhood of 50 per cent. In our personal experience we have never been able totally to

remove the lesion and our radical efforts were attended with such a high mortality that they have been abandoned. If on the other hand we content ourselves as we now do with the evacuation of the cyst and the removal of its presenting wall the mortality is almost nil but the condition almost invariably promptly recurs. The longest period of freedom from recurrence in my experience has been 17 years and although we have occasionally been able to tide a patient along by secondary operations we have never been able to prevent the death of the patient from this disease. Should the lesion be solid we are in no better case for at best we must be content with a partial fragmentary removal.

7 *Suprasellar meningioma* Isolated examples of suprasellar meningioma have been reported by Stewart in 1899 by Archibald in 1908 by Heinrichsdorff in 1914 and by Livierato and Cosmettatos in 1916. Holmes and Sargent published an excellent paper on the subject in 1927 and more recently (1929) Cushing and Eichenhardt have made a noteworthy contribution to the pathology symptomatology diagnosis and treatment of these tumors. In our small experience we have never encountered these tumors and our remarks concerning them do not emanate from personal experience but from data in the literature. The tumors arise from the meninges over the tuberculum sellae and are more or less intimately attached to the adjacent dura. Indeed nests of tumor cells may be found within the dura or extend through this membrane and into the underlying bone (Cushing). They are slow growing benign tumors assuming as a rule a spherical shape and presenting a granular mulberry like surface. In their growth they push the chiasm upward and backward the optic nerves straddling the tumor and being separated



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flattened and elongated. These tumors then in their earlier stages produce visual disturbances with bitemporal field defects but without deformities of the sella turcica and without glandular disturbances. In their advanced stages they may cause in addition to visual disturbances absorption or partial destruction of the sella turcica signs of hypopituitarism, disturbances in smell and finally internal hydrocephalus (Fig 35). In their treatment X rays as in all meningiomas promise little and these tumors if a correct diagnosis can be made should be promptly attacked surgically. Since they are suprasellar in origin they must be exposed by an intracranial approach. Cushing (21) has found that in their removal the excavation of the tumor with the electrosurgical loop has great advantages for it permits the collapse of the remaining shell of tumor which can then be grasped and delivered from its position beneath the chiasm. After the removal of the tumor its point of attachment may be cauterized. The results of the treatment of these tumors still leave much to be desired but it is evident from a study of the two largest series as yet reported that they depend upon early diagnosis and early operative treatment. Of the 10 cases reported by Holmes and Sargent all excepting one appear to be advanced cases. In 1 case a decompression was done for the relief of general pressure symptoms. In 8 a partial removal of the tumor only was possible. Of the 7 who survived this operation 3 showed some improvement in vision, 3 failed to show any improvement and 1 after a period of temporary improvement showed evidences of recurrence. In 1 case in the series a total removal of the tumor was accomplished with improvement in vision. It is interesting to compare this series with Cushing's in which either earlier operation was undertaken or different surgical methods permitted a higher percentage of tumor removals. Of the 15 cases which Cushing reports 1 died unoperated upon and 2 died following operation, 1 from hemorrhage from the ophthalmic artery. Of the 12 which survived operation the tumor was apparently totally removed in 8 partially and incompletely removed in 4. Of the 8 cases in which a total removal was accomplished there was improvement in vision in one or both eyes in 6, in the 2 remaining there was a checking of further loss or improvement of vision in one eye but a damage to one optic nerve with further loss of vision in the other. There was no evidence of recurrence in this group for from 1 to 1 years. In the 4 cases in which a partial removal was done 1 failed to show any improvement and died in 2 years, 2 failed to improve but

are living 3 and 5 years and 1 shows improvement in vision in one eye 10 months after operation.

8 *Parasellar* (prechiasmal, olfactory groove sphenoidal ridge etc) *meningiomas*. The parasellar meningiomas similar in their pathology to the suprasellar meningioma just discussed differ from them in their point of origin and location and therefore in their symptomatology. They arise from the basal meninges at the side or in front of the sella and may implicate the optic chiasm and nerves in their growth. Dandy (4) gave the name prechiasmal intracranial tumors of the optic nerves to a presumably rare form of meningioma surrounding the optic nerves at the optic foramina. Two instances of which he reported in 1922 (Fig 36). They produced visual disturbances due to direct pressure upon the optic nerves rather than to implication of the chiasm and it is noteworthy from the standpoint of diagnosis that the visual fields showed a concentric constriction rather than a form of hemianopsia. The olfactory groove tumors as their name implies arise from the basal meninges along the olfactory groove and in their backward extension may implicate the optic nerves and chiasm. The characteristic symptoms are anosmia a homolateral optic atrophy a contralateral choked disc and mental deterioration (Foster Kennedy syndrome). Similarly the sphenoidal ridge tumors arise from the meninges over the sphenoidal ridge and may implicate the optic nerves and chiasm in their growth and finally a group of these tumors arise from the meninges of the lateral walls of the sella turcica and compress the chiasm and optic nerves as well as in some instances the third fourth fifth and sixth cranial nerves. Although these tumors form a heterogeneous group from the standpoint of their eventual symptomatology yet they have these points in common that primarily they cause disturbances in vision which remain the important symptom from the viewpoint of treatment and that they are associated with primary optic atrophy and visual field defects which indicate involvement of the optic chiasm or nerves and in their early stages without sellar deformations. In their later stages these tumors may erode and partially destroy the sella turcica may cause signs and symptoms of pituitary insufficiency of involvement of the neighboring cranial nerves and of the uncinate gyrus and may cause contralateral or bilateral choked disc. In the treatment of all these tumors surgery alone at the present time is possible for as we have indicated in discussing the suprasellar meningiomas there seems little evidence that

they respond to X ray treatment. For their exposure the transfrontal intracranial approach to the chiasm will suffice for the prechiasmal and olfactory groove tumors but for those arising from the sphenoidal ridge and extending into the temporal fossa our lateral approach has some points of superiority. For the tumors arising from the lateral wall of the sella and extending downward into the temporal fossa a temporal approach may be necessary. The results of the surgical removal of these tumors have been satisfactory when removal has been possible. Thus far the number of cases in which removal has been attempted has been small. Correct diagnosis has been difficult and operation resorted to only when the tumor has reached a large size. Cushing (19) in 1927 reported the successful removal of four large olfactory groove tumors the first in 3 stages without the aid of the electrosurgical loop the three others in one prolonged stage (up to 9 hours) with the aid of this instrument. The only tumor of the sort in our experience was successfully removed in two stages. In Cushing's cases and in ours there was a most satisfactory improvement in vision with amelioration of other symptoms. Progress in the treatment of these tumors should be in the direction of correct early diagnosis and early operative treatment for up to the present time they have been so large when exposed that their removal has been a truly formidable procedure.

9. *Gliomata of the optic nerves and chiasm.* The ophthalmic surgeon has long been familiar with the gliomata originating from the optic nerves in their intra orbital portion and has been aware of the frequent associated involvement of the intracranial portion of the nerves and the chiasm. The neurologic surgeon has much more recently become interested in the primary gliomata of the chiasm and intracranial portion of the optic nerves and because of the occasional exposure of these lesions by an intracranial approach under the mistaken diagnosis of a suprasellar craniopharyngioma or other tumor. For many years these tumors were variously designated and there was great confusion in their pathological terminology. Verhoeff in 1922 after a careful study of these tumors concluded that practically all of them are gliomata and since that time they have been referred to under this title. They present on exposure a bulbous enlargement of the optic nerves and chiasm unmistakable when once seen (Fig 37). Usually the tumor is confined within the sheath of the nerves and chiasm but occasionally as in one of our cases it may break through the sheath at one point and present a

spherical nodule outside the nerves and chiasm but attached to them by a stalk or pedicle. The tumors have most frequently occurred in early life (under 12 years) but may occur in adult life. They may produce only the symptoms of headache visual disturbances optic atrophy and visual field defects or in addition may cause flattening of the sella turcica and clinical evidences of hypophyseal deficiency. In 6 of the 18 cases in Cushing's (19) series the condition was associated with von Recklinghausen's disease. While a diagnosis in the past usually has not been correctly made it is certain that we shall do better now that we are more familiar with the condition and chiefly by a better interpretation of the sellar changes and by the enlargement of the optic foramina. The treatment of the condition remains problematical. Since the primary indication for treatment is the preservation of vision the radical removal of the tumor if possible seems out of the question for it would cause the blindness one naturally wishes to prevent. It would seem at first thought that surgery has nothing to offer in the treatment of these tumors and could an accurate diagnosis be made they had best be left alone. I can find only a few recorded cases proved by operation in which X ray treatments have been given and in these there has not been any improvement in vision or checking of the loss of vision. Certain theoretical considerations suggest that we should not yet be completely discouraged regarding the treatment of these tumors. They are slow growing. My first case lived 4 years after the operative demonstration of an advanced tumor before vision was completely lost. My second case is living 1½ years after operation with vision actually (and unaccountably) improved. One of Cushing's cases lived 7 years after operation his vision being stationary for this period. In all carefully recorded cases visual disturbances have at first been unilateral and only subsequently has bilateral involvement occurred. In the majority of cases when first seen by the neurologic surgeon there was blindness in one eye impairment of vision in the other. These observations suggest that the lesion is at first unilateral and if this be so surgery might have something to offer (Fig 38). We need very much a series of accurate perimetric examinations in the very early stages of the condition for we could thereby gain a better idea of the starting point of the lesion. Again there is the possibility that longitudinal incisions through the sheaths of the nerves and chiasm (neuroschesis) might improve vision temporarily for because of the long duration of the

condition and an occasional autopsy description of nerve fibers widely separated by tumor tissue we get the suggestion that the nerve fibers are for a long time compressed rather than actually destroyed. Whether the release of the tumor from its enveloping sheath would cause the more rapid growth of the tumor into the surroundings and do more harm than good is problematical.

10 *Gliomata arising about the infundibulum.* In a personal series of 45 successive lesions about the chiasm exposed by an intracranial approach 5 (11 per cent) were found to be gliomata arising about the infundibulum or third ventricle. Martin and Cushing (68) in 1933 reported 233 lesions about the chiasm 6 (2.5 per cent) of which were gliomata arising in this neighborhood. It is probable that the high percentage of cases seen by me is unusual. Our pathological diagnoses can scarcely be at fault. Three of the tumors were solid and fragments were removed for microscopic section; two were partly cystic and the fluid was the typical yellowish fluid which promptly clotted. They clearly could be differentiated from other suprasellar lesions which we have seen at the operating table. They differ in their symptomatology from the other groups of tumors we have been discussing in that they more early produce a choked disc due to increased intracranial pressure, the result of occlusion of the third ventricle. Yet we know little of their early symptomatology for all the cases which have come under our observation have been late cases with either a choked disc with optic atrophy or an optic atrophy clearly secondary to a choked disc. They come under discussion here because they may be confused with the late stages of the various lesions we have previously discussed. They present the symptoms of headache, disturbances of vision, visual field defects, an enlarged or partially destroyed sella turcica, signs of hypopituitarism and ophthalmological changes which may be of the nature of a secondary atrophy or a choked disc with atrophy. In 2 cases we first confused the lesion with a cerebellar tumor. Their treatment is at present unsatisfactory. In one of our cases calcification of the large tumor occurred and the patient, when last heard from, was well although completely blind 10 years after the exposure and verification of the lesion. In another case X-ray treatments had for a few months a remarkable effect; the headaches disappeared, the vision improved and the patient appeared well. There was however an immediate recurrence of these symptoms which were unaffected by subsequent X-ray treatments.

11 *Cholesteatomata, dermoids, and teratomata.* These are rare tumors in the chiasmal region and we have not yet encountered any of them. Cushing (20) in 186 osteoplastic transfrontal explorations of the chiasmal region found 1 cholesteatoma in 219 cases of verified tumor producing symptoms of dyspituitarism; he (17) found 4 teratomata and 1 cholesteatoma. They are included only for the sake of completeness. In view of their rarity it is unlikely that for the present they will be correctly diagnosed. They present the symptoms of suprasellar tumors. Their treatment is surgical removal if possible.

12 *Suprasellar and parasellar aneurisms.* Intracranial aneurisms are not so uncommon as formerly supposed. Those which arise about the chiasm and may therefore implicate it and the optic nerves are chiefly the aneurisms of the internal carotid of the anterior cerebral and of the anterior and posterior communicating arteries. These comprised 53 or 34 per cent of the 154 cases of aneurism of the basal arteries of the brain collected by Gowers. A discussion of these lesions and their varied symptomatology need not be entered into here. Of interest in our present discussion is that they may cause visual disturbances, bitemporal or other visual field defects, destruction or not of the sella turcica, ocular palsies, anosmia and mental disturbances, unilateral optic atrophy and contralateral choked disc, etc. They may then simulate in their clinical manifestations the hypophyseal tumors, the suprasellar tumors and the olfactory groove tumors (20). Of especial interest is the small group of suprasellar aneurisms (15) described by Cushing (20), three of which were exposed and verified at operation (Fig. 39). They presented the clinical findings of visual disturbances, primary optic atrophy and bitemporal field defects with little or no changes in the sella turcica—a group of symptoms designated by Cushing as the chiasmal syndrome, common to many of the lesions we have been discussing. It becomes then of importance to recognize the aneurisms about the chiasm if possible before operation and certainly at the operating table, for the failure to do so in the latter instance may well lead to a serious and embarrassing situation. Their recognition before operation so far as I can gather rests more upon an accurate history—the history of sudden and perhaps repeated attacks of agonizing headaches, of temporary loss of consciousness and bloody cerebrospinal fluid—than upon any specific clinical findings. These are symptoms not of the lesion itself but of periodic leakage from a small rupture. In their absence, a

pre operative diagnosis may be impossible (Cushing's 3 cases). A subjective or objective bruit is usually absent. Concentric lamellæ of calcification as in one of our cases may suggest the correct diagnosis. Pfingst and Spurling emphasize the frequent association of ocular palsies as more or less significant. Their treatment if an accurate diagnosis can be made may for the moment be considered non surgical. I cannot find a recorded case in which after the unexpected exposure of one of these aneurisms a serious effort has been made to attack it by any of the methods used elsewhere in the cure of this disease. To the surgeon who has been confronted with one this is readily understandable and yet it might be quite possible to cure the small median subchiasmatal aneurism through the induction of clotting within its wall. No doubt this effort will sooner or later be made.

13 *Chronic cisternal arachnoiditis*. At least one condition other than tumors may give rise like them to visual disturbances of varying severity: primary optic atrophy and visual field defects which may be of the nature of a bitemporal hemianopsia but need not necessarily be so. The sella turcica is normal. For want of a better term the condition has been called chronic cisternal arachnoiditis. As was noted in preceding pages the space between the optic chiasm above and the sellar diaphragm below is occupied by the cisterna chiasmatis. In the condition which we are discussing the walls of this cistern are thickened and fluid collects within them under sufficient pressure to cause compression of the chiasm with resulting bitemporal field defects. This is undoubtedly one condition seen at operation but in addition to this there is apparently a condition of similar nature but without excessive distention of the chiasmatic cistern manifested chiefly by a thickening of the pia arachnoid around the optic nerves at their junction with the chiasm and extending forward to the optic foramina. The nerves seem embedded in and strangulated by a mass of adhesions as is seen sometimes in arachnoiditis involving the spinal cord. Under these circumstances there is instead of bitemporal field defects a more or less concentric constriction of the fields of vision. That I should have exposed these conditions 4 times in a recent series of 17 successive explorations of the chiasmatic region would suggest that the condition of chronic chiasmatic arachnoiditis is more common than has generally been supposed. Cushing in several articles on the chiasmatic syndrome refers to it and in one (c) reports a case operated upon for the symptoms of progressive loss of vision, optic

atrophy and bitemporal field defects. At operation the chiasm was found enveloped in a thickened and grayish arachnoid containing a great excess of fluid. There was no improvement in vision following the operation. Aside from this report—which Cushing states has not been his only experience—I fail to find any very definite references to the operative treatment of this condition. Of the 4 cases in my series all showed marked loss of vision (one blind) associated with a primary optic atrophy (one showed slight papilloedema). In 2 there were obvious temporal field defects in 2 a more or less concentric constriction of the fields of vision. In all the sella turcica was normal. In 3 there were no clinical evidences of hypopituitarism in 1 outspoken signs of hypophyseal deficiency. At operation a chronic cisternal arachnoiditis with adhesions about the optic nerves was the evident condition. In 3 of the 4 cases there was in addition to the condition about the chiasm a thickening of the pia arachnoid with an excess of cerebrospinal fluid over the frontal and temporal lobes exposed in our approach to the chiasm so that the chronic cisternal arachnoiditis appeared to be but a part of a more or less general condition. Following operation there has been a remarkable improvement in the vision of all 4 patients. One however has been so recently operated upon that statements regarding the late results cannot yet be made. Of the 3, 1 has satisfactory vision and is following his usual work 3 years after operation without as yet any signs of recurrence of the condition. 1 has satisfactory vision (can read the finest print) and is doing her usual work as a nurse 1 year after operation and 1 (previously completely blind) can with glasses read the finest print and is without symptoms of a recurrence of the condition 6 months after operation. Thus far then our experience with the surgical treatment of this condition has been quite satisfactory. The cases will be detailed at greater length in a subsequent report.

SUMMARY

1 The intracranial approach to lesions about the chiasm has become the operation of choice and has largely supplanted the transphenoidal approach even for tumors and cysts arising within the sella turcica.

2 Largely through a more consistent use of this approach a whole series of lesions about the chiasm unsuspected 20 years ago has come within the knowledge of the neurologic surgeon and their symptomatology, clinical signs and X-ray manifestations have come to be better

understood The ophthalmologist should make himself familiar with these lesions for to him per haps the majority of patients harboring them first come

3 The treatment of many of these lesions remains problematical It becomes evident that progress in their treatment would be facilitated if reports of the treatment of lesions about the chiasm were made with particular reference to the pathology of the lesions treated At the present time it is often difficult from the reports in the literature to get any accurate idea of the results of the treatment of lesions about the chiasm

4 The X ray has been a distinct contribution to the treatment of the hypophyseal adenomata both chromophil and chromophobe In certain cases it may check the growth of the tumor and delay or make unnecessary its operative partial removal It is a valuable adjunct and should in our opinion be used routinely in the postoperative treatment of these tumors It is possible that the improvement in the results of the operative treatment of hypophyseal adenomata attributed in part by us to the more logical removal of that portion of the tumor directly compressing the chiasm and nerves may in greater part be due to more frequent use of postoperative X ray treatments The use of this method is not without danger Its use as an alternative to surgery presupposes accurate pathological diagnosis for so far as our present knowledge goes the hypophyseal adenomata alone of the many lesions about the chiasm respond to it Its indiscriminate use in lesions about the chiasm may do great harm and it should in our opinion be given only with the knowledge and consent of those familiar with these lesions

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FROM THE UNIVERSITY OF CALIFORNIA HOSPITAL

STEPS TOWARD STANDARDIZATION OF PERINEAL PROSTATECTOMY

FRANK HINMAN A B M D F A C S SAN FRANCISCO

NO recognized surgical procedure shows more modifications and improvements during the last few years than perineal prostatectomy. The anatomical principles of approach and exposure as first presented by Hugh H. Young remain fundamental and will always do so if protection of the rectum and the muscles of micturition are to be secure. The perineal operator must know in all its complex details the anatomy of the male perineum. The topography of the region in relation to perineal prostatectomy was recently presented.¹ Since then certain modifications of method have proved so satisfactory that it seems appropriate to present them as an appendix of the method of procedure then in use. Not all are by any means original but have been developed in routine practice with associates as a group.² The operation as described in 1929 is transitional.

Modifications of Young's original technique have as objectives more complete visual *en masse* enucleation complete hæmostasis and an approach to primary healing with shortened hospitalization. *En masse* enucleation per perineum has raised the question of postoperative stricture suture and closure without packing or perineal drainage tube for purpose of primary healing that of secondary hæmorrhage and infection. These objections have been overcome satisfactorily but not to the point of considering the procedures used to do so as standardized or entirely perfect. Certain steps necessarily will change with the advance toward perfection of allied surgical procedures. The distinct and solid gains of the last few years in the surgical care of the prostate tending to make an already benign operation safer and to give better results in every way are worthy of discussion.

The problem of prostatectomy falls under four headings (1) preparation (2) anæsthetic (3) surgical technique and (4) postoperative care.

PREPARATION

The virtue of proper preparation for operation of every patient with an enlarged prostate is not universally recognized even by urologists. It should be. Why subject a man in excellent health with a large prostate but small residual that is free of infection to an arduous week or 10 days of catheter preparation? Why should a man who cannot be catheterized but whose bladder is not palpable not be operated on at once? The answer requires a detailed discussion of urinary sepsis of the physiology of micturition of antiperistalsis of the seminal tract and references to these aspects of the problem need be sent only to the inexperienced. Every case should receive prolonged catheter or cystostomy preparation for the simple reason—it is safer. This holds for whatever type of operation. But for perineal prostatectomy after which a urethral catheter is worn it is particularly important. Catheter preparation is preferred to cystostomy always for this reason. Optimum success in the operation as now done is secured largely by the man being able comfortably to wear a urethral catheter 5 to 7 days after operation. For this reason occasionally suprapubic enucleation is preferable when cystostomy has been required. But it is surprising with the proper trained assistance in the care of a retention catheter how seldom cystostomy is indicated—twice in 3 years in my experience.

Formerly the greatest burden of retention catheter was intercurrent epididymitis. Early bilateral vasoligation largely prevents this. Rarely a man gets an ascending funiculitis recognized as a tender cord running from the point of ligation through the inguinal ring which never gives as high a temperature or lasts as long as epididymitis. An associated seminal vesiculitis should be looked for and treated. It is in such cases when recognized before operation that radical prostatectomy with seminal vesiculectomy may be indicated.

SIMPLE TECHNIQUE OF VASA LIGATION

A simple and at the same time efficient technique of vasa ligation is with curved needles (No. 14). The scrotal skin with the vas is grasped firmly in the left hand so that the vas lies in the groove (made by pushing the thumb against the first and second fingers of the same hand)

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between the first and second fingers on the skin surface behind and the thumb on the skin surface above thus preventing its slipping away. The skin and subcutaneous tissue with the vas are anesthetized locally on whichever surface is more convenient. A curved needle is passed in and out of the upper or lower skin layer just beneath the vas and at right angles to it the needle's passage being easily guided by the sense of touch of fingers and thumb holding the vas. *Hæmostats* to the same side on the needle at base and tip make of it a retractor to lift the vas which now lies just beneath the skin surface in the curve of the needle. A short incision over the belly of the needle exposes the vas which can be felt to roll beneath the finger on the needle. A second curved needle can be used to lift the vas out of this bed freed of its capsule. It is then doubly ligated and divided.

ANÆSTHESIA

Spinal anæsthesia has become popular and is ideal for the operation of prostatectomy. Respiratory complications are practically eliminated with its use. The fall in blood pressure is sometimes serious. Labat's rule of keeping the head low continuously should be rigidly followed. Spinal is much quicker easier on the patient and for this reason usually more satisfactory to the surgeon than sacral and paravertebral block. When anæsthesia fails with the latter gas and oxygen are required. All things considered spinal anæsthesia when not contra-indicated is comparatively safe but sacral anæsthesia is safer in the long run of cases even when many of these will require gas. Recently we have used local infiltration anæsthesia successfully doing a complete operation with bladder discomfort and fullness as the only complaint of the patient. We are inclined to regard sacral with local infiltration when needed as much safer than spinal anæsthesia.

OPERATION

The minor modifications of method pertain to exposure enucleation hæmostasis retention catheter and closure.

It is unnecessary in every case to *expose* the posterior prostatic surface widely by complete division of recto-urethral muscle. With the long urethral tractor of Young first advocated for use in seminal vesiculectomy (Geraghty's or Crowell's tractors are preferred by some) the prostate is lifted into the field and after division of conjoined tendon and a few of the more superficial recto-urethral fibers is palpable. The bulb need not be freed nor lifted to expose the

membranous urethra. The anatomical relation of transversus perinei on each side to the central point of perineum under the bulb is better left undisturbed. Little use is made of anterior traction. The sense of finger touch localizes definitely the central point of the perineum by feeling the shaft of the tractor in the urethra just below (above—on operating table) the prostatic apex and the line of rectal reflection on the bulging prostate beneath is known to be near this in the midline. Division of all these tissues to free the rectum is only occasionally necessary (in cancer or when radical removal is in mind). The edge of the right levator ani is stripped down from where it hugs the right lateral surface of the prostate beneath. Holding it down with the left index finger the loose tissues covering the prostate are divided by cutting down on the right lateral prostatic surface below the apex as presented to the operator until the glistening membrane of Denonvillier is reached. The right lateral surface can at once be readily exposed by blunt dissection. Working toward the midline and opposite side from the patient's right to left it is usually possible to obtain quite satisfactory exposure for enucleation without complete division of rectal attachments by pushing these over to the left carrying the rectum along. (A left handed operator would prefer working from patient's left to right.)

En masse enucleation is not imperative. Quite as good results may follow segmental removal. But freeing the enlargement in one piece has advantages for thoroughness and better surgical repair. The peculiar nature of prostatic enlargement is significant here. Prostatic hyperplasia affects perurethral glands not true prostatic glands. These latter are pushed away from the neck carrying ejaculatory ducts and are all compressed together posteriorly to form the false capsule of the enlargement. Preservation of ejaculatory ducts in view of almost universal duct ligation preparatory to operation is no longer matter of concern.

The enlargement has no real relation to the true prostatic lobes. A (middle) commissural lobe enlargement a lateral lobe enlargement an anterior lobe enlargement do not mean hyperplasia of the anatomically recognized middle lateral or anterior lobes. That is why the posterior lobe has never been known to hypertrophy. In this sense none of the others do either. But any one of the six lobes may undergo malignant changes. Hyperplasia arises from groups of small glands sometimes anterior in the majority lateral and posterior between the region of

verumontanum and neck closely related to and surrounding the urethra. Their relation to the commissural group of Randall, the subcervical group of Albarran and the sublingual group of Home is uncertain. Hyperplasia of these periurethral glands except the Albarran and Home pushes the true lobes away from the bladder, elongates the urethra and may produce intravesical projections which are never pedunculated. Structurally the anterior lobe is chiefly smooth muscle, glandular tissue being insignificant and that is why there is such a thin false capsule anteriorly as compared to the one posteriorly after enucleation. Prostatic enlargements of size therefore actually separate the prostate proper with the verumontanum and external sphincter from the vesical neck. The fibers of the trigone described as passing over the sphincter to attach near the verumontanum must be separated therefrom by such enlargements and the mechanism of internal sphincter relaxation cannot be satisfactorily referred to this pull. Micturition is quite normal after prostatectomy which has destroyed the attachment. Enucleation then removes a periurethral growth distinct from the prostate proper which itself has been pushed posteriorly and compressed by it. Randall finds the subcervical group hyperplasias always pedunculated and intravesical and for this reason advises the suprapubic route. But they are quite easily removed perineally even when practically the only enlargement. I have once found such a pedunculated growth antero left lateral which was easily removed with its entire mucous covering through the internal sphincter perineally. A complete cystoscopic diagnosis of the type of hyperplasia present is always necessary if one chooses the perineal approach; otherwise these rare pedunculated growths might easily be overlooked.

A wide crescentic incision of this compressed prostate or false capsule permits thorough freeing of the hyperplasia at the neck, separation and preservation of the encircling internal vesical sphincter fibers, division of the urethral mucosa below the external sphincter and radical removal of this unit growth with that portion of redundant mucosa belonging to it. Such *en masse* removal does not predispose to stricture provided repair of the distorted relations is surgical and not left to haphazard restitution by packing the cavity left behind with rolls of gauze as most of us did formerly. Even then stricture was extremely uncommon but instrumentation was later sometimes difficult or impossible because of urethral distortions of such unsurgical restitutions.

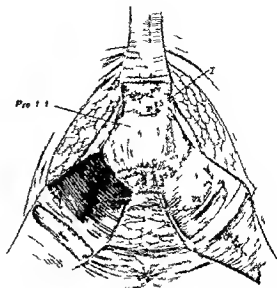


Fig 1 Incision of the urethra at the apex of the prostate. A short incision into the mid portion of the levator muscle layer on each side permits wider retraction with two deep posterior retractors instead of one thus giving better exposure. The seminal vesicle tractor shown diagrammatically with blades open in the bladder (placed too low in the figure) lifts the prostate into the field. Portions of seminal vesicles are seen at the base of the prostate.

Hemostasis is of immediate importance; structural repair of later though equal if not more importance. The two benefit by joint consideration. The anatomical situation after enucleation by way of the perineum through the crescentic incision of the posterior prostatic surface is the large cavity previously occupied by the periurethral hyperplastic mass. This ragged cavity is bounded vesically by the orifice of the bladder with its more or less dilated sphincter and its ragged mucosal edge which is completely separated from the urethra anteriorly by the insignificant thin anterior capsule and muscles denuded of mucosa posteriorly and laterally by the thicker false capsule of compressed true prostatic tissue carrying ejaculatory ducts which by reason of earlier incision presents lateral lamellae and a central flap but also denuded of mucosa and urethral by the completely divided urethra held in relation to the cavity by the lateral lamellae of the false capsule. The major hemorrhage is seen to be at the bladder neck posteriorly and laterally. Mattress sutures one on either side entering the lateral lamella at the farthest possible point to the side, piercing the sphincter and mucosa of the neck at the corresponding octant and coming back through both 1 centimeter below, effectually control bleeding as a rule and eliminate the dead space of the cavity.

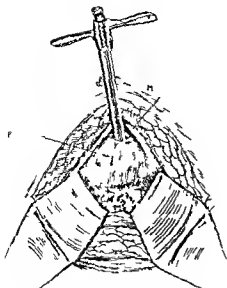


Fig 2 Division of urethra at apex of prostate. An

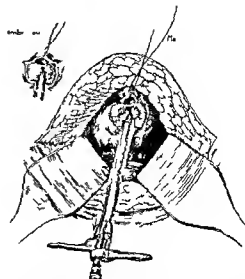


Fig 3 Division of urethra at apex of prostate. An

laterally and posteriorly. The flap layer of the false capsule is sutured into place after placement of a urethral catheter.

A urethral catheter is placed for the purpose of urethral restoration as after resections of the bulbous membranous urethra for stricture and is retained as a rule 5 to 7 days. It is always removed on the seventh day and the urethra is thoroughly irrigated once or twice for a few days. Should there then be urinary leakage through the perineum it is sometimes replaced for 3 to 4 days or so until the perineum remains dry without it. Wildbolz has recently advocated suturing the vesical neck to the urethra as described below in radical prostatectomy in his partial prostatectomy operation (Fig 5).

The flap of compressed prostate is next sutured into proper relation with the lateral lamellae by tight closure and the recto-urethral fibers previously pushed aside are now drawn back in place over it. Suture of levator an completes the closure. No packing is used.

Infection. Complete closure increases the danger of postoperative infection. Dependent drainage has been the advantage of the perineal route. Can we deliberately cast it aside? An antiseptic solution in the bladder such as permanganate of potash or mercuric iodine and thorough irrigation of the operative field during the course of the operation and before closure are not always sufficient. Occasionally abscesses form in

the closed tissues. We are now working on a system of capillary tubes after the Carrel method in wounds so that the field can be percolated with Dakin's or similar fluid for a few days after operation.

RADICAL OPERATION

Occasionally men come for operation who have long suffered with urinary sepsis, prostatitis and vesiculitis. Their enlargement is a late complication. Simple removal of the enlargement fails to give them as much relief as it should. Frequent and burning may continue and pyuria be constant but with no residual. Pyelonephritis, lithiasis, vesical diverticulum, etc. are often responsible for such seeming failures of prostatectomy but a not infrequent one easily corrected if recognized at the time of operation is seminal vesiculitis.

In those cases that have had a free exposure of the prostatic surface when of size one is impressed by the relatively thin layer of compressed prostate left after enucleation of the hyperplastic mass. It is so thin and broad as to appear antagonistic to good restoration of the urethra. There is nothing left anteriorly and only a broad posterior thin layer containing ejaculatory ducts—unnecessary after vasa ligation. The whole false capsule might easily be sacrificed. Structural

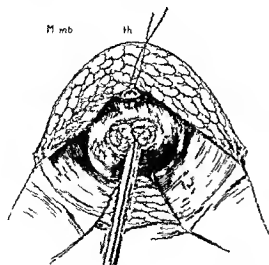


Fig 4 Extracapsular enucleation is completed. Very little bleeding is encountered less than usually follows intracapsular enucleation of a hyperplastic mass. Usually the vesical mucosa can be broken through anteriorly inside the sphincter with a finger or incised. Through this opening the short tractor or a spoon tractor is inserted to define the vesical neck from which the prostate is now carefully dissected. The seminal vesicles are then freed by blunt dissection the vasa isolated ligated and divided and the whole prostate both vesicles and ampullae come away in one piece. (See Fig 7)

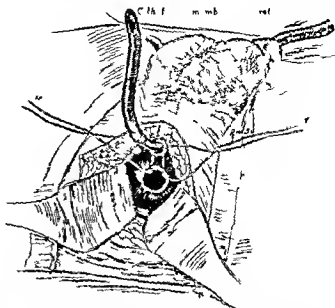


Fig 5 Anastomosis of vesical neck to membranous urethra. After the deeper sutures are placed the urethral catheter is turned into the bladder and 3 to 5 other sutures complete the anastomosis.

restoration would not be endangered thereby. Sphincter preservation would be identical.

With this in mind five radical prostatectomies have been done for hyperplasia complicated with chronic vesiculitis and the results have been entirely satisfactory so far as control and postoperative course are concerned.

The vesical neck is sutured to the membranous urethra by two anterior and two or more posterior sutures and the denuded prostatic space is thereby completely eradicated as shown in the accompanying illustrations (Figs 1 to 5).

POSTOPERATIVE CARE

A detailed discussion of postoperative care is not intended. Methods of catheter care—as to type, how and when to irrigate, with what and the period of changing of urethral hygiene when to empty periodically or drain continuously, when to apply suction or continuous irrigation etc.—are extremely important if the catheter is to function for 5 to 7 days or longer. What follows about secondary hemorrhage has not been seen mentioned yet the simple procedure has proved of great value on three occasions.

Secondary or postoperative hemorrhage may occur from the third to the fourteenth day. It amounts to little after that. The seriousness of

the complication is not loss of blood so much as retention because the bladder fills with blood clots. Rarely can they be satisfactorily aspirated through the catheter, not even the Coude. Patients cannot stand repeated cleansing of the bladder with a metal instrument such as a clot evacuator. Besides if such procedure has to be repeated it means too much loss of blood as indicated by falling blood pressure and shock. Formerly with open perineum it was quite simple to repack, but with perineum tightly closed it is not so simple. Now after one or two aspirations of clots according to circumstances we stop such secondary bleeding which is found usually to come from the vesical neck by fulguration of the bleeding points through a McCarthy urethro-

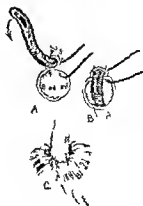


Fig 6 Sketches showing method of inserting urethral catheter.

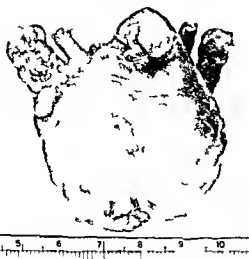


Fig 7 Photograph of gross specimen after adrenalectomy

scope. Only thrice has this been indicated but each time was effective.

To conclude the discussion of after care should be mentioned a procedure the value of which at times is not sufficiently recognized. Occasionally a rather acute *pyelonephritis* complicates a prostatic convalescence starting frequently coincidentally with establishment of voluntary

micturition. Should a high temperature and leucocytosis persist more than 3 or 4 days ureteral catheters should be placed and retained a few days being irrigated every 2 hours (mercurochrome alternating with salt solution). It is a matter of surprise and satisfaction to see the temperature promptly reach normal in most of these cases under such management.

RESULTS

It is not intended to give detailed analysis of cases. Procedures are still being modified. No standard method has been reached. Not all cases even of the last few months have had complete closure. But this undoubtedly is the right objective. It shortens hospitalization. Cases which have had primary healing may now go home any time after the eighth day. If they go within 2 weeks it is a surgical triumph. Formerly the prime consideration was mortality. It is still so. But when the mortality of a major operation falls as low as that of perineal prostatectomy less than 3 per cent for all types of cases major consideration becomes improvement of convalescence and results. Better methods of preparation, better anesthesia and better methods of postoperative care must share with an operation that gives better healing and function (complete hemostasis) further reduction of this already low mortality rate.

THE SURGICAL TREATMENT AND MANAGEMENT OF PHARYNGO-ŒSOPHAGEAL DIVERTICULUM

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MY purpose in presenting this article is to review the interesting phases of the evolution of the two stage operation to outline a detailed plan of surgical management and to report a typical case of pharyngo œsophageal diverticulum. Only the pharyngo œsophageal pulsion diverticulum (Zenker) will be considered.

These diverticula arise from the posterior wall of the œsophagus at the lower end of the pharynx on a line with the cricoid cartilage. It is a herniation of the mucous membrane and submucosa of the œsophagus through a weak point known as the Laimer Hackermann point near the junction of the inferior constrictor muscle and the longitudinal muscular bands of the œsophagus.

Dr Chevalier Jackson calls attention to an inordination of the cricopharyngeus muscle in which the muscle fibers pull in opposite directions and create the weak spot through which the protrusion occurs. This weak spot is between the pars obliqua and the pars fundiformis of the cricopharyngeus muscle (the inferior constrictor of the pharynx). Continued mechanical pressure at this bulging point gradually increases the size of the sac until it produces symptoms. The sacs vary in size from that of a pea to a large pear. During deglutition pressure distends the posterior wall.

It occurs more frequently in men than in women (about 4 to 1). The usual ages reported are from 42 to 80 years averaging between 50 and 60 years in individuals who are more prone to other hernias and in those who show a congenital tendency toward diverticula elsewhere.

Surgical treatment giving satisfactory results began about 25 years ago. Previous to this the mortality ranged from 16 to 23 per cent.

HISTORICAL DATA ON THE SURGICAL TREATMENT

Wheeler of Dublin in 1886 reported a case cured by the surgical removal of œsophageal diverticulum. Von Bergman and Theodore Kocher reported other successful removals of diverticula in 1892. Girard of Berne 1886 reported 2 cases in which he invaginated the pouch into the œsophagus and sutured the external aspect of its neck with three layers of sutures. No obstruction resulted. A. E. Halstead of Chicago treated a case in 1904 by a similar method: he invaginated the sac, applied a purse string suture around the neck, and covered this

with three rows of sutures in the œsophagus. Their idea was to avoid opening the pouch or the œsophagus. Halstead pointed out that this method was adapted only to diverticula of small size.

This technique was improved and modified by Bevan who reported the Sippy Bevan operation in 1917. A series of longitudinal and circular pursestring sutures were inserted in the wall of the sac. The tying of these obliterated the pouch.

Halstead (4) developed a two stage operation which he practiced for a number of years but as far as I know did not report it until 1919. The first stage consisted of the isolation of the sac twisting it on itself transversely and suturing it to the upper end of the wound. The second stage was done 10 to 15 days later when the wound was reopened and the sac removed by cautery. A pursestring suture was applied around the neck of the sac; the stump was invaginated into the œsophagus and the longitudinal fibers sutured over it.

Goldmann recorded 2 successful cases operated upon by the two stage method in 1907. He isolated the sac as in primary excision but instead of cutting off the pouch turned it upward and sutured the fundus to the upper angle of the wound. Later he modified this technique by constricting the sac lightly with catgut; the skin then being sutured except at its lower end. A second stage was done 10 days or more later when the wound was reopened the pouch excised and sutured as in the one stage operation. Goldmann also reported having ligated the neck of the sac tightly to insure strangulation and necrosis of the pouch packing it high in the wound with gauze and only partially closing the skin, leaving it open for drainage. The second stage consisted in removal of the sloughing sac in a week or two but leakage occurred and resulted in an unclean procedure which was not too free from risk.

When the Goldmann two stage operation is mentioned today it generally refers to the one in which the sac was turned up and ligated loosely with the idea to prevent food and air from entering the pouch yet not having it tight enough to cause strangulation and necrosis.

Wilke and Hartley modified the Goldmann operation by incising the pouch and performing a submucous resection of the mucosa which they removed leaving the fibrinous coat that they had

invaginated and closed the opening by purse string suture. Later Frank H. Lahey improved this procedure by making a thorough isolation of the sac to its neck and a high implantation in the wound, suturing the sac to the skin or the parathyroid muscles if the sac was short. At the second stage he did not attempt to remove all the walls of the sac because of the danger of reopening the space behind the oesophagus. The neck of the sac was exposed and the sac cut off with scissors, thus exposing the submucosa which was separated from the wall down close to where it joined the oesophagus. This mucous membrane was cut away and a strip of boric acid ointment impregnated gauze was passed into the sac canal, thus pushing some of the loose mucosa ahead of it.

C. H. Mayo at the first stage sewed the sac to the sternocleidomastoid muscle without ligating or twisting the sac. The second stage was done 10 days later. Judd's (7) technique consisted in freeing the sac in the usual manner carefully separating the adhesions from the anterior wall of the sac to the posterior wall of the oesophagus up to its neck, suturing the neck of the sac to the sternocleidomastoid or platysma muscles with a few interrupted sutures and closing the wound around the diverticulum. At the second stage the wound was reopened to the neck of the sac, the sac was ligated with a pursestring suture and removed without any attempt to suture over the wall of the oesophagus.

In 1923 Judd found less than 200 cases operated upon but since then many more have been added and it is evident that this condition is being recognized more frequently. Practically all cases that come to surgery have been treated for several years on an erroneous diagnosis.

Between 1907 to the present date there have been published many excellent articles dealing with the two stage operation by Goldmann, Halstead, Murphy, Mayo, Judd, Lahey, Hill, Sturgeon and others.

SYMPTOMS

A. Dysphagia

B. Large amount of mucus expectoration particularly in recumbent position

C. Discomfort in the throat

D. Spitting up of food which does not appear to have been in the stomach several hours after ingestion

E. Loud gurgling splash on swallowing due to mingling of swallowed air and food

F. Regurgitation of food at the table and sometimes long after a previous meal

G. Discomfort in swallowing rather than difficulty in getting down ample food for nourishment

H. Sensation of choking

I. Pressure on the neck above clavicle eliciting succussion splash as contents of sac are ejected

J. Obvious palpable swelling of neck generally on left side

K. Occasional fit of coughing and choking. Sometimes patient can eat satisfactorily only while in recumbent position. Liquid and soft food swallow easier than hard food such as rice, raw apples, beans, etc.

L. Some patients state that when they eat they can be heard all over the house causing embarrassment.

M. Later loss of weight, evidence of starvation.

N. Attacks of temporary stagnation of food and overdilated sac which obliterates the normal opening of the oesophagus. During these attacks patients are unable to get nourishment into the stomach.

DIAGNOSIS

The symptoms may come on very slowly beginning with an irritable throat and excessive expectoration of mucus and later dysphagia. Many patients have complained of these disturbances for several years and have been treated for various throat disorders. I believe under ordinary circumstances a diverticulum of sufficient size can be diagnosed in a few minutes. It is usually the impression of these patients that they have some kind of a growth in the neck. If there is dysphagia and one's suspicions are aroused, have the patient swallow a half glass of water then inspect the neck for visible swelling (which occurs in about 1 in 5 cases) above the clavicle usually on the left side of the neck. If sac is present compressing the neck will cause it to empty whether there is visible swelling or not. A gurgling sound or splash will be heard as the water regurgitates back into the throat.

Confirmation of diagnosis on this basis must be made by a roentgenological examination. If the patient is given a few ounces of barium meal the sac will fill and be seen under the fluoroscope. By having the patient continue to drink the barium mixture after the sac is filled it will show the meal entering the oesophagus below the sac stricture below can usually be ruled out. Oesophagoscopy is indicated in these cases and may confirm the diagnosis of diverticulum also may rule out stricture and neoplasm. The danger of perforation of any instrumentation however is great and unless expertly done may do much harm. Judd does not recommend oesophagoscopy as routine means.

ure not only because of the danger involved but also because frequently very little information is obtained. If the roentgenological examination reveals the typical shadow produced by these sacs there is practically no danger of error in diagnosis.

TREATMENT

Treatment should always be surgical unless the diverticula are small. These are more difficult to operate upon than the larger ones and usually do not produce marked or distressing symptoms and may be treated medically until they become larger and more troublesome. The medical management consists of dilatation of the œsophagus with olive-tipped bougies. The patient should be taught to keep the sac empty by pressure upon it or by lavage with a small catheter. The symptoms produced by large sacs might be controlled by this management if operation were contra-indicated. I know of one case which Halstead reported, that was under his observation for 24 years. The patient daily lavaged and emptied the sac which was very large but did not obstruct the œsophagus. Operation was refused and the patient managed to keep in fairly good health.

Prognosis of pulsion diverticula is considered serious not only from the standpoint of progression of dysphagia, pressure symptoms and starvation but marks the risk of perforation by sharp foreign bodies, resulting in mediastinitis and cellulitis. In a recent article Meyersburg (10) reported a traumatic mediastinitis. His patient swallowed some borseradish containing particles of glass and developed immediate pain in the throat. Roentgenogram showed a typical diverticulum and extravasation of the barium about the œsophagus.

The two-stage operation of sac isolation and excision is so satisfactory that it can be recommended in preference to all other types of surgical treatment.

SURGICAL MANAGEMENT

Preparation. The patient must be in good nutritional state at the time of operation. Blood transfusion is considered if there is a definite secondary anæmia. If there is any evidence of dehydration and starvation forced feedings should be instituted. Formerly it was recommended that a preliminary gastrostomy be done for this feeding but this procedure is probably never necessary at the present time if feeding is done by use of the duodenal catheter (Levine tube). With the patient in a recumbent position the catheter which has been lubricated with glycerine is passed through the left nostril. If it meets obstruction by passing into the sac, it should be withdrawn and patient made to swallow some

semi-solid food. Then when the patient is in the attempt is made while the patient is in the water. Passage into the œsophagus is accomplished. Should this procedure fail the patient swallow three times and then twist at night and three times the following morning (method of H. S. P.). The thread has passed into the œsophagus and taut it will serve as a guide for the duodenal catheter.

After the catheter is passed in the patient six to eight egg-nogs well sweetened with 25 per cent glucose solution are given daily until the patient's condition is satisfactory. The catheter is removed from the œsophagus for the first time. It should always be left in for the second time.

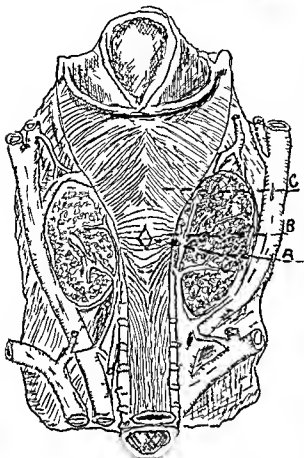
Patients in apparently good condition be put to bed in hospital a few days before operation. The day preceding the operation an intravenous infusion of 1,000 cubic centimeters of 10 per cent glucose in Ringier's solution is given. The mouth, gums and teeth should be thoroughly cleansed. One half of one per cent mercuric solution may be used for a few days before the amount is swallowed and allowed to enter the sac after it has been washed out and cleaned. Amylase is given the night before the operation. The patient is kept in sufficient pain to keep the patient quiet but co-operative.

Anæsthetic. Infiltration anæsthesia with novocain after pre-operative sedation is the anæsthetic of choice. The operation is desirable when the sac is large. Cervical block is satisfactorily administered however the patient in which painful and persistent neck, shoulders and arm occurred. Ethylene is found necessary to use an anæsthetic.

First stage operation. The patient is raised the patient lies on the left side elevated on a sandbag the head is turned to the right thus making the left side uppermost. The skin is prepared in the usual manner.

The approach is generally from the left side unless the diverticulum is more prominent on the right. The incision may be used. Important landmarks are the thyroid gland, the sternocleidomastoid muscle and the common carotid artery.

The incision is made on the right side of the sternocleidomastoid muscle, 2 to 3 inches long. It starts at the thyroid cartilage and ends at the cricoid cartilage.



F A t m u c l e l a t A L n H k e m a
 p o t e t f n n B p e r b o d f t h c d e a t
 g C p r s b l q f t h e c n p h a r y n g s m s c l

incision is carried through the skin superficial fascia and platysma. The muscle is exposed carefully care being taken not to traumatize the muscle fibers as this might start troublesome oozing. This operation can be done almost bloodlessly. The fascia is separated from the anterior surface of the muscle with a Kocher director and is stripped away from the inner side of the muscle the separation being continued down in front of it to the carotid sheath. The carotid artery can be recognized by feeling its pulsation with the index finger of the left hand. The finger will serve as a guide for further dissection will help in retraction and will protect the vessels from injury.

Visible veins (the lateral thyroid veins) may occasionally have to be ligated if they interfere with exposure. It is best not to ligate the inferior or superior thyroid vessels this would be quite an added hazard in case of infection sloughing and slipping of ligatures would cause serious hemorrhage.

The spinal accessory nerve will probably be seen high in the medial surface of the muscle and should be protected. The dissection is carried down to the inner side of the thyroid sheath the finger still serving as a guide. The sternocleidomastoid muscle is retracted outward and the omohyoid downward. The omohyoid muscle can usually be displaced and seldom requires cutting. The sternohyoid muscles the left lobe of the thyroid and the trachea are displaced inward by retraction the deep thyroid fascia or deep cervical fascia which forms the capsule of the thyroid gradually is blended externally with the carotid sheath. This is visualized and with the index finger of the left hand still serving as a guide the fascia is opened with forceps inside close to the vessel of the carotid sheath. The wound is made larger and deeper by careful blunt dissection. By palpating with the finger at the depth of this opening the anterior surface of the vertebral column is felt. Directly in front of the vertebra will be seen the œsophagus in the form of a red tube in the bottom of the wound. By having the patient take three or four swallows of water through a glass tube the sac will become inflated partially filled with air and water and present itself in the wound.

The next step of the operation is the most difficult and important phase of the entire procedure as Lahey and Judd have so well illustrated in recent articles. By taking hold of the fundus of the sac with the rubber protected intestinal forceps causing traction and with the aid of the Kuettnner gauze dissector the lower end of the sac can usually be freed quite readily.

Adhesions which are quite dense may be found between the anterior surface of the neck of sac and the posterior surface of the œsophagus. These adhesions must be separated up to the beginning of the sac without injuring the sac or the œsophagus. One can judge how high to carry this dissection by using the superior border of the cricoid cartilage as a guide. As practically all these openings begin at the level of the cricoid cartilage one can readily be sure that his dissection is complete if the sac is free to this point. If the adhesions are easily broken down no difficulty will be encountered but where they are resistant and dense it may be necessary to snip some of them with scissors. Good exposure must be established for this procedure and if found necessary the wound may be enlarged so as to permit better visualization.

When the sac is large gauze should be packed in the bed of the sac as it is being separated from its adhesions this will protect the tissues from

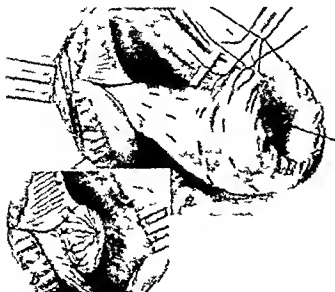


Fig 2 Sippy-Beyan operation infolding of sac (From Surg Clin Chicago 1917)

infection should the sac or oesophagus be damaged. A small leak may result in the dreaded mediastinitis. If an accident has happened this gauze should be removed after operation is completed and replaced by iodoform gauze and the wound left open for 48 hours. The iodoform gauze may then be removed, a smaller piece inserted and the wound closed. A large opening is left in the skin wound for drainage.

This dissection properly completed the success of the operation is assured. There is an advantage in using the rubber protected intestinal forceps (Schoenberg's intestinal clamp spring handle $7\frac{3}{4}$ length) and Kuettners gauze dissector with good retraction and light dissection can usually be carried out successfully through a small exposure.

The sac isolated it must be sutured in the wound high enough to change the direction of its opening in the oesophagus to prevent food and water from entering it. The neck of the sac is attached with a few interrupted sutures to the sternocleidomastoid muscle, prethyroid muscle or skin depending upon the size of the sac. Large ones may be marsupialized and the fascia closed with a few interrupted sutures and the skin closed with clips to the neck of the sac. If the sac is too small to be brought out through the skin it is sutured to the prethyroid muscles (Lahey). In re-opening the wound for the second stage the sac will be more easily identified if a fine chromic cat gut mattress suture is applied in the fundus carried through the skin and tied over a small piece of gauze (Halstead).

Trouble has been encountered following the first stage operation with large sacs becoming

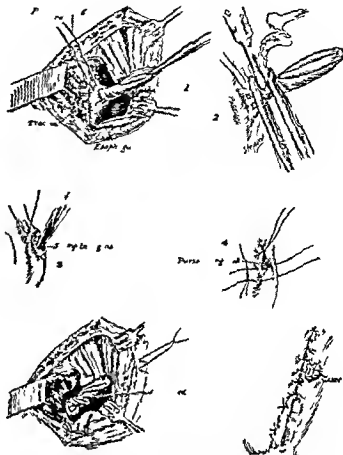


Fig 3 Halstead two stage operation (From Surg Clin Chicago 1919)

gangrenous as a result of being overdistended with air and secretions. Both the methods of Goldmann loosely ligating sac at its neck and that of Halstead and Murphy twisting the sac to obliterate its lumen have been condemned because occasionally gangrene followed. However both of these procedures properly done will effectively prevent this overdistention provided they do not interfere with the circulation of the sac.

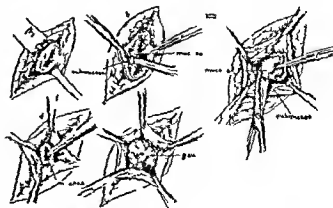


Fig 4 Lahey second stage operation (From Surg Gynec & Obst August 1930)

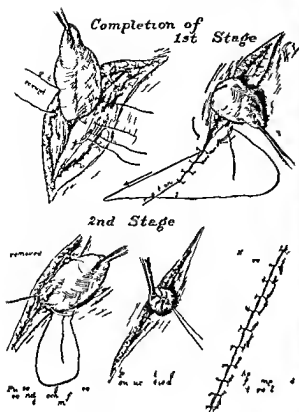


Fig 5 Jdd two tg pe n (l m A ch Surg
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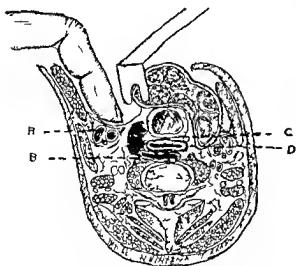


Fig 6 A t m e l l t s of th sac A C o t d
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r i t h d D e r s o p h u

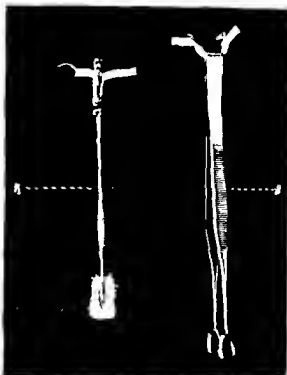


Fig 7 i K t t d t B S h b e r g s t e s t l
mp

Lahey opens the fundus of the sac and sutures in a duodenal catheter this being used for giving nourishment. This overdistention can frequently be avoided even when the sac is large if the patient tolerates the catheter well and does not swallow for a few days. The sac usually shrinks during the period between the stages of the operation.

Second stage operation. The second stage may be done 7 days later. At this time sufficient adhesions will have formed between the fascia planes and the loose cellular tissue in the prevertebral space also the cervical lymphatics will probably have been sealed so that the mediastinum will be walled off and protected against invasion by infection should subsequent leakage take place.

The operation will be found exceedingly simple. The wound is re opened to the neck of the sac where it had been fixed to the muscle at the previous operation the neck of the sac ligated with chromic catgut No 1 tied snugly but not too tight and the diverticulum removed. A small piece of iodoform gauze is inserted down to the stump the wound is closed with a few interrupted catgut sutures in the fascia and the skin with clips down to the drain. The edges of the skin that surround the sac after the first stage should be freshened up to insure good healing at this place.



Fig 8 Roentgenogram anterior view



Fig 9 Roentgenogram lateral view

A large number of these cases will have some drainage of swallowed fluid in from 3 to 6 days however this drainage should not cause discouragement as the sinus will usually heal in a short time

AFTER TREATMENT

The catheter should always be inserted before the second stage of the operation is performed and left in about 5 days. Forty eight hours after the operation it may be withdrawn after the last feeding of the day and reinserted again in the morning. The patient is again warned against swallowing. If there is marked discomfort sodium amylal or other sedative may be administered. The patient is permitted to swallow some liquids after 4 or 5 days and the wound is observed to see whether or not there is any leakage. If there is none a liquid diet is given. If leakage occurs the catheter is reinserted during the day and feedings given for 3 or 4 days more by this time the drainage has usually stopped or is very slight.

The wound is dressed daily. The iodoform gauze that had been inserted down to the œsophagus is removed and a fresh drain of iodoform gauze is replaced until food is swallowed without leakage then the wound is permitted to heal.

REPORT OF TYPICAL CASE

111 M. aged 54 years male. The family history was irrelevant. Patient had had pneumonia twice but no other

illness. For 10 years patient has had difficulty in swallowing food. This dysphagia gradually became worse. Three weeks ago he was unable to swallow at all for several days and since then has been able to get down only thin liquids. He has had soreness in his throat for years. This soreness became quite acute since his inability to swallow a few weeks ago. In the morning he would frequently cough up food that had been eaten the night before which did not appear to have been in the stomach. He also complained of the sensation of a lump in his neck. Treatment had been given for throat trouble. He was embarrassed when eating in company and generally arranged to eat alone. People in an adjoining room could hear the gurgling noise in his throat when he swallowed. There had been a loss of 20 pounds in weight in the last 6 months.

Physical examination disclosed no visible lump in his neck after swallowing food or liquids but by applying pressure on the neck above the clavicle a succussion splash was heard when swallowed air and food was expelled back into the throat.

A barium meal was administered and patient examined under the fluoroscope. A typical pulsion diverticulum shadow was found. By applying pressure on the neck while under the fluoroscope the sac was emptied and the barium meal regurgitated back into the throat. The sac appeared to be about the size of a hen's egg. More barium was given and the sac was seen to fill after filling swallowed barium could be seen to trickle down past the sac into the œsophagus. Roentgenoscopy did not give evidence of stricture or other pathology in the œsophagus below the diverticulum.

Diagnosis pharyngo-œsophageal diverticulum

Patient was admitted to hospital November 11, 1930. On admission urinalysis was negative but blood count and hæmoglobin were normal. Intravenous infusion of 1000 cubic centimeters of 10 per cent glucose was given. An attempt was made to pass the duodenal catheter through



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SUMMARY AND CONCLUSIONS

1 The technique as outlined in this article has proved to be a satisfactory method of surgical management of Zenker's diverticulum

The crux of the procedure centers around the complete and successful isolation of the sac to its beginning without opening the sac or the esophagus

3 The second stage is simple the wound is reopened and the newly formed adhesions around the sac are separated down to its neck the neck is ligated and sac is removed The ligature should not be tied too tightly If the neck of the sac is large this ligature may be applied with a needle picking up the mucosa in three or four places and twin as a pursestring suture without invaginating the stump

4 Many cases will have some drainage of swallowed fluid in from 3 to 6 days however these fistulas usually will close if feedings are continued by catheter and swallowing is prohibited a few days more Discomfort from the catheter will be minimized by removing it after the last feeding at night and reinserting it the next morning

5 Three factors that aid in forming cicatricial tissue which re-enforces the posterior pharyngeal wall are as follows (a) irritation following the first stage operation (b) irritation produced by the iodoform wick (c) irritation resulting from drainage following the second stage operation

6 Stricture rarely follows postoperative dilatation of esophagus is unnecessary in most case

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CANCER OF THE LIP

REPORT OF EIGHTY EIGHT CASES FROM THE STEINER CLINIC¹

CALVIN B STEWART M.D. ATLANTA GEORGIA

CANCER of the lip may seem to be a rare disease but statistics have proved that the condition accounts for from 3 to 5 per cent of all deaths from cancer. In the Steiner clinic during the 5 years ending January 1930 we have treated 88 cases in a total of 5 500 cases of cancer and allied conditions—an indication that cancer of the lip is a serious problem.

As to etiology the same questions present themselves as in all cancer cases. Some believe that for every cancer there must be a separate cause but if we are honest with ourselves we must confess profound ignorance as to etiology. The patient frequently gives a history of having a fever blister which has never healed. In a few instances however there is a definite history of irritation or trauma for instance the patient may have sharp teeth he may have carried nails in his mouth he may have smoked a short stem pipe the protruding under lip may have been too much exposed to the sun or the neoplasm may have arisen on a leucoplakia.

Statistics from this clinic agree with those in the literature that the lower lip is affected more often than the upper the ratio being 20 to 1 but as to sex incidence our figures show that the male leads with the ratio of 29 to 1 whereas the literature gives the ratio as 16 to 1. The figures may change in the future since women now use tobacco more commonly than formerly.

As to age incidence our figures substantiate those in the literature. The ages range from 23 to 85 years the decade most commonly affected being 50 to 60 years.

In cancer of the lip the pathological picture varies materially ranging from sarcoma to adult cell carcinoma. So nearly all are of the squamous cell variety that we can pretty well regard the others as rarities. Clinically we find the classification into the papillary and infiltrating types to be of great value. In the papillary type the growth spreads over considerable lip margin but metastasis occurs late. Although the infiltrating type may look very insignificant it is very resistant, prone to recur and metastasis occurs early and is extensive.

The diagnosis is usually made on the history of a persistent lesion which has grown progressively worse in spite of all efforts to relieve the

condition. While the lesion usually ulcerates early it does not necessarily do so. The cardinal diagnostic points as I see them are first a persistent sore on the lip usually the lower lip second a lesion that when gently palpated with one finger in the mouth discloses a definitely indurated base unless it be of the papillary variety and third a lesion in which when the crust is removed the granules are found to be bristly and the exposed surface usually bleeds easily on sponging. The growth must be differentiated from (1) simple ulceration (2) leucoplakia (3) tuberculosis and (4) syphilis.

Usually the simple ulcerations are of short duration and the patient gives a history of trauma as operation injury medications etc. In these lesions the bristly granulations and induration are lacking.

Leucoplakia with ulceration offers great difficulty in diagnosis. Leucoplakia is a precancerous lesion and there must necessarily be a time when only one cell is cancerous if in 1 month after local destruction by means of fulguration there is no induration and no recurrence then the growth probably is not malignant. The patient must be carefully watched however for any evidence of recurrence.

The tuberculous ulcer is usually a manifestation of generalized disease. In this type the surface of the growth resembles the consistency of apple butter and the base of the growth is not so firm.

Syphilis can be recognized by the rapid progress of the disease and the early diffuse relatively soft lymphadenopathy. In addition usually spirochaetae can be demonstrated or a positive serum reaction can be obtained. The admission of the patient to exposure to syphilis also helps.

Our study of lip carcinoma covers the period from October 1924 when the Steiner clinic was opened to January 1930. We are making no claims for cures but merely wish to report our observations for what they are worth. The institution has gone through many trials in organization during the period of this study but fortunately the care of the lip cases has not changed materially. Our follow up system has not been all we would have liked due to the financial depression. It is a fact too that in many



Fig 3 lft C Papillary carcinoma flap with t
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I w f fd 4y d g m ths ft t tm t

instances the patient considers lip cancer as only of minor importance and once he is free of local disease he considers further trips to the hospital superfluous. Other factors affecting our follow up were the fact that the street names and numbers in Atlanta have recently been changed and finally that when we first opened the clinic we had no social service department.

Our policy has been not to make biopsies in early lip lesions. We believe that this procedure stimulates metastasis and necessitates the loss of some of the lip. We prefer to have combined opinions of two or more trained in this work. Of course after deep ulceration has taken place the removal of a small specimen at the edge of the growth can do no harm.

The treatment consists in eliminating the irritating factor if any and then making a mold of the lesion of warm dental modeling compound. A special effort should be made to get the material well down into the buccal, gingival groove and beyond the lesion in all directions. Each side of the neck is exposed to an erythema dose of filtered X rays. The primary lesions are treated by means of radium which is placed in the skin side of



Fig 3 lft C I g f t l k g inflt t g
les on lip with de in eck (Goup 2)
Fig 4 C se Lpt treated with rad m d ght n k
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k w d ct d N des f m b th d f th eck
h w d m m p e t dy Now f f
d sease

the mold described and the mold is held in position by the teeth. A satisfactory reaction will temporarily remove the epidermis from the area exposed. The raw surface thus produced is rather uncomfortable to the patient for about 2 weeks beginning 7 days after treatment. Healing takes place after about 30 days. The patient has only a blanched out area but there is no deformity.

Metastases fortunately seldom go beyond the glands of the neck and for this reason we prefer to leave the glands to act as sieves in case of cell emboli. We feel that if the patient is periodically examined the nodes can be detected in time to remove before the capsule is broken. When nodes are found they are removed by unilateral block neck dissection and at this time gold filtered radium emanation tubes are buried in questionable areas. These radium tubes probably do more than the thorough dissection to prevent recurrence. If the nodes cannot be removed surgically gold tubes sufficient to sterilize them are left in the mass the sterilizing dose being about the equivalent of 10 skin erythema doses.

For clarity of description we are using the following classification. Group 1 includes cases in which only the lip is affected. In Group 2 in addition to the lip lesion there are definite but movable nodes in the neck. Group 3 includes the far advanced cases in which the lesion involves the jaw or there are inoperable glands of the neck. In the first group we had 64 cases in the second group 18 cases and in the third group 6 cases.

Of the total of 88 cases we have failed to trace 31 to date. Of the 31 only 7 never returned for observation. These we are willing to count as dead from their disease. The 24 remaining were followed from a few months to 4 years and were free of disease on the last visit. We do



Fig 5 lft C se 3 Lp pla ed by Typ p d m d
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largd (G p 3 d t o p n o t l o)
Fig 6 Case 3 Th e m ths aft m l f th lip
d p n o t e m w th thermal ca tery Nodes m d
small after X ray xpos re Ca l t

not feel that these should be classed as dying from cancer especially as all but 6 were Group 1 cases. Of the 88 cases only 3 were females and in only 4 in the 88 was the upper lip affected.

The primary lesions were treated with radium. There were 74 such cases. Occasionally when an area was obstinate gold filtered tubes of radium emanation were buried in it. Surgical measures were used in 17 cases and in 2 cases electro coagulation alone was used.

In Group 1 in which there were 64 cases 24 have been lost track of. This leaves 40 traced cases. Of these 2 died of the disease. One died of heart disease 3 years after treatment. This patient had been free of signs of malignant disease during this period.

In Group 2 we have failed to trace 3 of the 18 cases. Five patients died 1 of pneumonia 18 months after treatment but he was free of any evidence of malignant disease at death. Another patient died with nephritis 3 years after treatment but he had remained free of malignant disease after radium treatment and two neck dissections. This leaves 3 who died of their disease and 2 who are now under treatment for recurrent nodes. Of this group only 8 are now free from recurrence from 1 to 5 years after treatment.

In Group 3 all 6 patients are dead or lost. Four are known to be dead. Some of these advanced

cases however were markedly relieved by means of irradiation.

SUMMARY AND CONCLUSIONS

- 1 It is too early for us to report end results.
- 2 Epithelioma of the lip can be destroyed by radium without causing deformity.
- 3 In the treatment of cancer one should not be limited to any one agent—metastatic nodes should be removed surgically when possible and radium emanation should be left in questionable areas.
- 4 Inoperable nodes can be sterilized by radium implants.
- 5 Advanced cases can be relieved by means of small doses of X ray or radium.

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ROENTGENOLOGICAL PELVIMETRY AND INTRA-UTERINE CEPHALOMETRY

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F. M. H. R. G. L. G. I. D. P. M. T. T. H. U. T. Y. F. M. Y. I. D.

ONE of the earliest investigations undertaken with the roentgen rays was a systematic study of the various stages of development of the osseous system. It was found that the first radiable center of ossification occurs in the clavicle about the seventh week of embryonic life and that there follows a regular and systematic development of the bones to birth and through infancy, childhood, puberty, adolescence and old age. This makes it possible by a study of the roentgenograms alone to tell the approximate age of the fetus or individual examined.

Muellerheim in 1898 was the first to mention the use of the X rays in pregnancy. As technical difficulties were overcome and better roentgenograms were obtained there naturally followed a study of the fetus *in utero*. Little was known of the biological effect of the roentgen rays at this time and no one dreamed of the deadly possibilities lurking in them. Their fascinating properties lured on the unsuspecting enthusiasts who at first regarded them as being as harmless as they were interesting. Then slowly but surely the eyes of the medical profession were opened to the serious and even fatal results that followed the indiscriminate and careless use of the rays, persistent cutaneous ulcerations or burns developed in those who were long exposed to their action.

About the same time it was observed that pregnant women who had undergone extensive roentgen ray treatment or who had been exposed to the rays for long periods of time frequently aborted or gave birth to defective or malformed offspring. Naturally there arose in the minds of many members of the medical profession considerable fear as to the use of the roentgen ray and this was especially true as regards its obstetric indications.

Investigators have demonstrated that the roentgen ray has a selective action on embryonic tissue and that the sensitiveness of the embryonic cell is greatest when its productive activity is most intense. Reports have been published which conclusively demonstrate that it is possible to produce changes in the ovum or fetus by prolonged exposure to the roentgen ray, altering its development and resulting in the birth of a mentally or physically defective child. While many normal and healthy infants have been born fol-

lowing long exposures to the roentgen rays opinion is almost unanimous that women of the child bearing period should not receive therapeutic doses until the possibility of pregnancy is absolutely eliminated.

What has just been said regarding the therapeutic application of the roentgen ray has no bearing on its diagnostic use in which only short and infrequent exposures are given. Reports are now available of many thousands of pregnancies in which the roentgen ray has been used for diagnostic purposes in both the early and late stages without any injurious effect whatever either to mother or child. Since the fear of the roentgen ray for diagnostic purposes in pregnant women has largely disappeared and as technical and mechanical improvements in apparatus have taken place the roentgen examination has been able to furnish more and more information valuable to the obstetrician.

It would be difficult to conceive of a more positive sign of pregnancy than the visualization of the fetal skeleton and Williams in his latest textbook refers to the roentgen method as the fourth positive sign. The fetal skeleton should always be seen on the X ray film during the latter months of pregnancy irrespective of the size of the patient and should be seen in most instances as early as the fourth or fifth month. Under favorable conditions a positive diagnosis of pregnancy can now be made as early as the third month. A little over 2 years ago I made serial roentgenograms of 10 patients who were supposed to be less than 2 months pregnant. X raying them regularly every 2 or 4 weeks until a fetus was visualized. Two showed the fetal skeleton about the twelfth week, 2 about the fourteenth and 3 about the sixteenth week. Three proved not to be pregnant. All 7 of the pregnant women gave birth to normal babies; there were no ill effects shown although some received a many as ten exposures during the early weeks of pregnancy.

Among the factors which complicate early visualization are the thickness of the abdominal walls and soft parts surrounding the fetus, the presence of amniotic fluid and the distance of the fetus from the film whereby the slightest movements are exaggerated thus blurring or obliterating

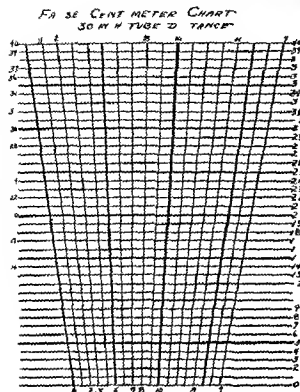


Fig. 1. Centimeter meter chart, 30 inch tube distance

ing the delicate outlines of the bony skeleton. However, some of these difficulties may be overcome by pneumoperitoneum or by inflating the bladder or rectum with air. Multiple pregnancies can very readily be made out and in several instances triplets have been diagnosed before birth by means of the roentgen ray.

A roentgen examination should always be made whenever a differential diagnosis is to be established between pregnancy and uterine tumor. Serious and mortifying mistakes may be prevented if the abdominal surgeon insists upon a roentgen examination before attempting a hysterectomy for supposed fibroma or myoma, especially when such a growth is accompanied by menstrual suppression. Abnormalities of the fetus can be determined with greater certainty and at an earlier date with the roentgen ray than by any other means, and a number of fetal monsters have been discovered before birth. Case in 1922 was the first to diagnose an anencephalic monster with the roentgen ray prior to its birth. Campbell and Webster reported the second in 1924. Several have been reported since, and to these I can add 2 more cases. The number will undoubtedly increase as the use of the roentgen ray becomes more general in obstetrical practice. The importance of making a positive antepartum diagnosis of a monstrosity or grossly defective child cannot be overestimated. Death of the fetus



Fig. 2. Patient in semi-reclining position, ready for first exposure

(if not recent) can usually be diagnosed before delivery by the roentgen ray, through the demonstration of an overriding of the cranial bones and shrinkage of the skull contents.

Much has been written about roentgen pelvimetry, and a large number of methods have been described, most of them too complicated to be practical. Aside from Thoms' excellent work on fetal cephalometry, described in the *Journal of the American Medical Association* July 6, 1930, very little has been done to measure accurately the head of the child before birth. It may be just as difficult or even impossible to deliver a hydrocephalic child through a normal pelvic canal as it would be to deliver a normal child through a contracted pelvis, and unless the roentgen examination can determine the size of the fetus, the pelvic measurements must necessarily be of limited value. The following method of measuring both the maternal pelvis and fetal skull has been used in the Roentgenological and Obstetrical Departments of the Maryland University Hospital for over 2 years, and its simplicity and practicability recommend its more general adoption.

A chart (Fig. 1) is used, showing the degree of distortion at centimeter heights above the film at a fixed tube film distance. This chart can easily be made for any technique by making exposures of a perforated centimeter rule suspended at various heights between the film and tube.

The first film is made with the patient on the Bucky diaphragm in a semi-reclining position as described by Thoms. The back is supported at a proper angle to bring the plane of the pelvic inlet parallel with the X-ray film (Fig. 2). The distance between the film and top of the symphysis pubis is then measured. The target of the tube is then

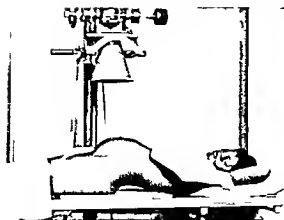
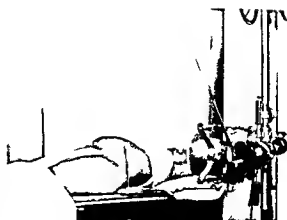


Fig 3 P t f p t t t m k r a l m m t

placed 30 inches above the film the central ray being directed vertically through the center of the pelvis. The exposure made in this position shows the outline of the pelvic brim enlarged in proportion to its height above the film. By measuring with calipers the diameters of the pelvic brim on the film and checking these against the centimeter scale on the chart at the height of the symphysis above the film the corrected or true measurements of the pelvis are obtained.

The same procedure is used in making the cranial measurements. The position of the head of the child is located as accurately as possible either by manual or roentgen examination. An exposure is made with the patient lying flat on her back, the tube 30 inches from the film and centered over the head of the child (Fig 3). The distance from the center of the child's head to the film is measured. A second exposure is made with the patient lying on her back, the film this time is placed against her side nearest the baby's head and the tube centered opposite on a plane with the skull at a distance of 30 inches (Fig 4). The distance between the center of the skull and the film is again measured.



F 4 F l m w t d o f t t w h m b l

When the films are ready for examination the diameters of the fetal skull as shown on the films are measured with calipers and checked against the false centimeter scale at heights corresponding to the distance of the head from the films in the different exposures and the corrected or actual size of the fetal skull is obtained. The fronto-occipital and biparietal measurements are given because they are usually the easiest to obtain.

The advantages of this method are

- 1 Its accuracy in determining the size of the maternal pelvic inlet and the fetal head before delivery.
- 2 Its simplicity in that no special or complicated apparatus is required.
- 3 All the preliminary work can be carried out by trained technicians.
- 4 It takes but very little time to compute the measurements after the films are ready to examine.

I would like to acknowledge the cooperation of the Obstetrical Department of the University of Maryland, particularly the help given by Dr. L. H. D. G. J. M. R. and Dr. M. A. N. y. w. h. k. i. d. t. n. f. h. g. m. t. i. h. a. m. d. t. p. o. b. l. t. c. a. y. i. t. h. w. l. d. n. b. d. t. h. p. p.

SUPERFICIAL AND DEEP CONTINUOUS SUTURE

SUPPLEMENTARY REPORT

JACOB SARNOFF M D BROOKLYN

Att d g S geo U t d I t z a H p t l d B m H d E t n w l k H p l l

IN the *American Journal of Surgery* of July 1929 I described in detail a combined superficial and deep continuous suture—a new hemostatic approximation and tension suture. In this article I stated that I had personally used this suture on my surgical service both at the United Israel Zion Hospital and the Brownsville and East New York Hospital in about 300 cases during the previous 3 months with most gratifying results.

It is now about 2 years since this article was published and I would like to present a supplementary report giving both my personal experience with it and the reaction and experience of many other surgeons throughout the country who have adopted the method. I will not present at this time a detailed description of the suture as it was fully described in the article mentioned. Figure 1 however shows the essential principles of the simple technique.

It is natural for the originator of a new procedure at times to be overenthusiastic about it.

In this respect the writer proves to be no exception. However I believe my enthusiasm is justified for the results have been so satisfactory that in the past year the suture has been used in over a thousand cases to the exclusion of any other continuous suture.

Whenever a continuous suture is indicated especially in the skin it has been my practice to use the combined superficial and deep suture which has fulfilled all the requirements and in addition has the following advantages:

1. The suture is simple and speedy of execution. It is foolproof; the edges cannot invert nor evert. The novice becomes master of the suture at the first attempt (Fig. 1).

The suture evenly approximates the deep parts of the skin as well as its finest cut edges. It thus provides two wide opposing raw surfaces for healing with a resulting firm subcutaneous as well as cutaneous union of the cut edges. The deep part of the suture takes away any tension on the skin edges and the scar therefore does not stretch and widen out as happens with the average suture (compare Figs. 1 and 2).

3. The suture prevents puckering between the stitches which is unavoidable with interrupted sutures and it maintains an even and constant

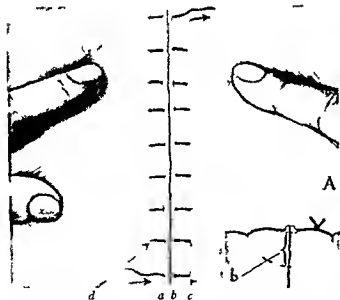


Fig. 1. Superficial and deep continuous suture. Needle enters at *a*, passes through skin edges and comes out at *b*, passes through skin and subcutaneous tissue at *c*, then goes to *d*, and the same process is repeated. Note firm and even approximation at line of incision with no tendency toward separation even when tension is applied to it. Inset A shows the wide and close approximation of raw surfaces of skin and subcutaneous tissues *b* brought about by use of this suture. Compare with Figure 2.

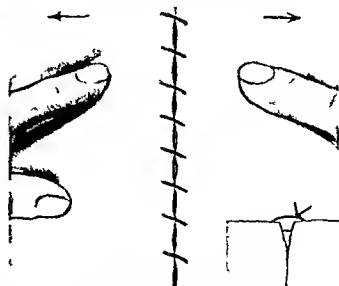
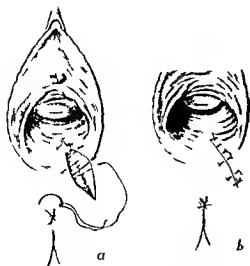


Fig. 2. Ordinary continuous suture. Note gaping and separation of skin edges between sutures that may take place if tension is applied to them.

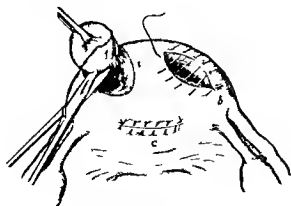


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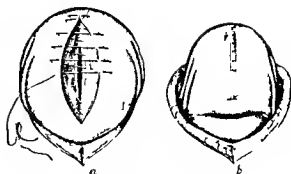
tension on all the tissues at the line of suture. One may compare it to a zipper with its many advantages over buttons.

4 The suture effects complete hæmostasis at the suture line and obliterates dead space—factors conducive to primary union in its fullest sense in all clean cases.

5 The suture is removed with great ease and the scar left after healing is almost invisible.



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c l t d b S t t e d t d d p e d t h g h
d p d p h l p o t f t w l l e S t
m p l t e l



F 4 S t f u t r u i c r e s a e c t U t
p t y t d T h e s p f l b t f t h s t r e
c l d p t m d d o f m l w l l T h d p b t
o f t l d l m t t h w h l t h c k o f t
l l p t t m m m b b S t m p l t d

It is my purpose in this supplementary comment to point out in more detail the cases in which this suture can be used to great advantage and why. Originally it seemed to me to be adaptable mainly in closing the skin edges following laparotomy, but later I as well as many others who have used it found it advantageous in a great many other ways.

To illustrate. An obstetrician of a recognized hospital told me one day that he had been using this combined superficial and deep suture to great advantage in closing episiotomy wounds and perineal lacerations following labor. As I had not



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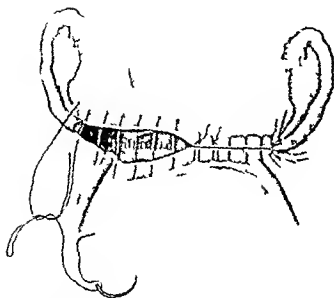


Fig. 7 Suture continued 1 ft half completed. Right half shows suture passed through cutaneous fibroad ligament but not tightened.

practiced obstetrics for over a decade his statement took me by surprise but on further discus

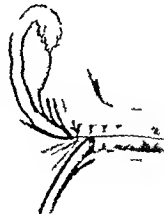


Fig. 8 The suture line of continuous suture

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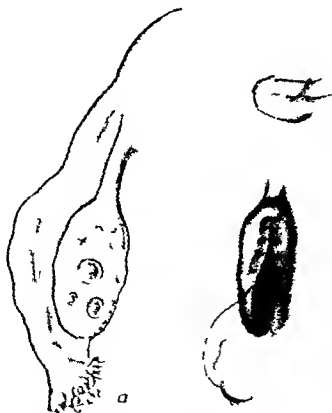


Fig. 9 Suture continued 1 ft half completed. Right half shows suture passed through cutaneous fibroad ligament but not tightened.

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Fig. 3a. Illustration of the combined superficial and deep continuous suture (Fig. 3a) makes possible with very little difficulty and in a very short time the approximation of all these layers with one suture. First we take a superficial bite of either edge of the cut mucous membrane at the extreme upper end, then a deeper bite to include also the cut muscles and fascia, then a superficial bite, and so on until the mucous membrane, muscles, fascia, and skin are evenly approximated in a few minutes. In this way dead

space is obliterated, even approximation of the cut structures is obtained, and perfect hæmostasis is secured (Fig. 3b).

Likewise in closing the uterus following cesarean section (Fig. 4a) one can save a great deal of time and obtain all the desired results with this suture. Here the superficial bite includes mainly the peritoneal edges while the deep bite includes the entire thickness of the muscle wall of the uterus except the mucous membrane, so that even approximation of the uterine incision, perfect hæmostasis, and peritonealization are obtained in a very short time (Fig. 4b). The entire procedure should not take over a minute.

The suture is especially suitable in closing the uterine incision following a myomectomy (Fig. 5). In the past 5 years I have made it an almost universal practice to do a myomectomy instead of a hysterectomy in removing uterine fibroids in young women, especially in those desirous of bearing children. In a number of such cases it seemed hardly believable that a myomectomy would be practical; nevertheless many fibroids—subperitoneal, intramural, and intraligamentous—were successfully removed. The fibroids ranged in size from that of a walnut to that of a grapefruit, and as many as twenty have been found in one patient. Following the myomectomy, the uterus is left in fairly good condition for future pregnancies. In two instances I have removed two large degenerating fibroids of the uterus which were causing acute symptoms in primiparæ in the sixth and seventh months of pregnancy, and in both instances the patients went on to full term and were delivered of healthy offspring. In these cases as well as in others the combined superficial and deep suture is most advantageous. By means of it the cavity produced by the enucleation of the fibroid is obliterated and the deep raw surfaces of

the uterine wall are brought into contact, and the dead space is obliterated. The suture is especially suitable in closing the uterine incision following a myomectomy (Fig. 5). In the past 5 years I have made it an almost universal practice to do a myomectomy instead of a hysterectomy in removing uterine fibroids in young women, especially in those desirous of bearing children. In a number of such cases it seemed hardly believable that a myomectomy would be practical; nevertheless many fibroids—subperitoneal, intramural, and intraligamentous—were successfully removed. The fibroids ranged in size from that of a walnut to that of a grapefruit, and as many as twenty have been found in one patient. Following the myomectomy, the uterus is left in fairly good condition for future pregnancies. In two instances I have removed two large degenerating fibroids of the uterus which were causing acute symptoms in primiparæ in the sixth and seventh months of pregnancy, and in both instances the patients went on to full term and were delivered of healthy offspring. In these cases as well as in others the combined superficial and deep suture is most advantageous. By means of it the cavity produced by the enucleation of the fibroid is obliterated and the deep raw surfaces of

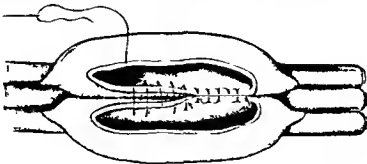


Fig. 3b. Illustration of the combined superficial and deep continuous suture (Fig. 3b) makes possible with very little difficulty and in a very short time the approximation of all these layers with one suture. First we take a superficial bite of either edge of the cut mucous membrane at the extreme upper end, then a deeper bite to include also the cut muscles and fascia, then a superficial bite, and so on until the mucous membrane, muscles, fascia, and skin are evenly approximated in a few minutes. In this way dead

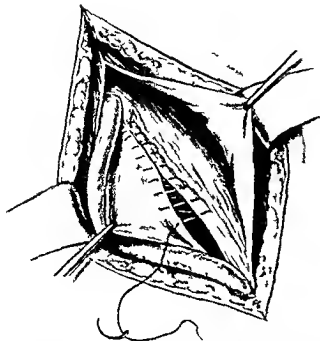


Fig 12 Bassini hernioplasty with author's suture. It approximates a double fold of Poupart's sheath to a wider and thicker portion of conjoint tendon and thus avoids tearing through some of the fascial strands when suture is tied

the uterine wall are approximated so that the uterus is peritonealized the cut muscles are approximated and perfect hæmostasis is secured

The chief difficulty after a supravaginal hysterectomy is to obtain perfect approximation hæmostasis and peritonealization at the site of the cervical stump and broad ligaments. Proper technique demands a coring out of a cone shaped portion of the cervix to facilitate such approximation (Fig 6). In these cases the superficial deep continuous suture is most ideal for the superficial bite approximates the peritoneum and free edges of cut cervix while the deeper bite includes a good thickness of what is left of the cervical stump (Figs 7 and 8).

Very few structures require more careful and delicate handling than do the ovaries. Following partial resection of cystic ovaries the cut surface may resemble an olive from which a segment has been removed (Fig 9). It is best to approximate the entire depth of these cut surfaces and this can be best accomplished with this suture.

In suturing the raw surface of the liver following cholecystectomy the cut peritoneal edges are generally brought together thus leaving a hollow tunnel between the liver bed and the sutured peritoneum. In this suture by getting a bite of the liver bed at the same time the dead space can be obliterated with little effort (Fig 10).

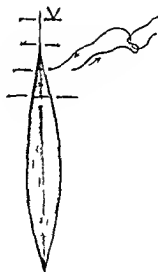


Fig 13 The author's figure of eight superficial and deep suture

The average continuous through and through suture used for closing the posterior wall in a gastro enterostomy does not effect an even approximation of the cut edges of the mucous membrane muscle and peritoneum of the stomach and intestines. However if this suture is used as illustrated the approximation can be made more perfect (Fig 11).

Likewise in a Bassini hernioplasty the approximation of the conjoint tendon to Poupart's ligament can be made more effective with this suture and a wider and firmer approximation and union obtained between these structures (Fig 12).

This suture does not preclude the use if the surgeon so desires of an additional interrupted stitch to reinforce the line of approximation in operations such as the Bassini hernioplasty perineorrhaphy or cesarean section. (To avoid confusion such sutures have been omitted from the illustrations.)

In the presence of suppuration if a continuous suture is deemed inadvisable or in approximating muscles and fascia as in a Bassini hernioplasty if the surgeon prefers an interrupted to a continuous suture the writer would suggest his superficial and deep interrupted suture in the form of a figure of eight as illustrated (Fig 13). In reality this suture is two interrupted superficial and deep sutures combined in one. An appropriate name for this suture would be a figure of eight superficial and deep suture.

In thyroidectomy the surgeon and especially the patient are very much concerned about getting an almost invisible scar and here again our suture is ideal for the purpose (Fig 14) for it

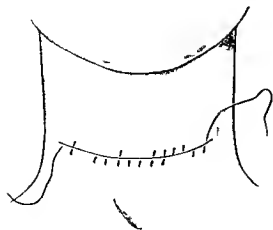


Fig. 4. A. D. L. K. T. F. L. T. H. Y. F. E. C. T. M. Y.

brings together in perfect approximation the subcutaneous tissue and the edges of the skin. In lead in a good many cases the writer was unable to locate the site of the incision after the wound healed. Even the stitch holes become invisible in a very short time when the suture material is removed at an early date that is within 3 or 4 days following the operation. Having approximated the platysma separately with a catgut suture there is no fear of the separation of the skin even if the suture is removed at an early date.

The suture is indeed most desirable in plastic surgery of the face following automobile accidents etc. when the greatest concern of the patient is to get as little disfigurement as possible. For the ambulance surgeon or general practitioner who is called upon in an emergency to sew up lacerations so frequently met with these days this suture has many advantages. The facilities under these circumstances are as a rule not of the best and to get proper approximation with interrupted sutures consumes a great deal of time requires more preparation suture material and needles. With our method however one suture will accomplish the same result with a saving of time and with less chance of the wound becoming infected.

The incidence of wound infection not only in the writer's experience but also in that of a great many other surgeons has been greatly lessened since the adoption of this suture as a routine in clean cases. It has been found especially useful in securing perfect cosmetic results in plastic surgery. Here the wounds are usually clean.

In brief the suture is of practical value in the following instances:

- 1 Closure of skin wounds of any kind
- 2 Repair of perineum following episiotomy or lacerations
- 3 Closure of uterus following caesarean section
- 4 Suturing of cervical stump following hysterectomy
- 5 Suturing of uterine wall following myomectomy
- 6 Suturing of the cut ovarian surfaces following partial resection of ovary
- 7 Peritonealization of liver bed following cholecystectomy
- 8 Suturing of conjoined tendon to Poupart ligament in Bassini hernioplasty
- 9 Approximation of the posterior wall in gastroenterostomy
- 10 Approximation of the bisected kidney cortex following nephrotomy

There are many other instances in which this suture can be used to great advantage but space will not permit their mention. The suture will be found more and more useful as the surgeon becomes accustomed to its use. It is time saving and technically perfect. It is conducive to perfect hæmostasis, primary union, firm healing and an almost invisible scar.

It is gratifying to learn that the suture has been received with enthusiasm by many general surgeons, gynecologists, orthopedists and others in the profession, as is evidenced by communications from these men, all of whom state that they have found the suture of great value in their respective fields of surgery. The writer is grateful to them for their fair expressions of opinion as to the merits of the suture and for their helpful suggestions as to its adaptability, even in field somewhat foreign to the writer.

SUSPENSION OF THE UTERUS

MODIFICATION OF TECHNIQUE

R W LAGERSEN M D MINNEAPOLIS MINNESOTA

WHENEVER numerous methods are advocated and in use for the treatment of a surgical condition one is instantly struck by the philosophy that any or all of these procedures leave something to be desired. Obviously, if any one method was wholly satisfactory, it would be used to the exclusion of all others.

Most discussion of uterine suspension is concerned with the shortening of the round ligament at or near its juncture with the uterus or at its point of passage through the abdominal wall, the choice of location of shortening lying with the individual operator and with the pathological condition which may or may not be present in the tubæ uterinæ.

Of the operations which have been devised to shorten the round ligament at its uterine end the one most in vogue is the Baldy Webster. It is not wholly satisfactory for several reasons the first of which in these days of considerations of peritonealization is the possibility of raw areas at points of suture with subsequent adhesions in these locations.

A second is the possibility of sutures being burned out rapidly with breakdown of the suspension before agglutination has taken place between the serosa of the round ligament and the serosa of the uterus.

A third reason is that but one sixth to one third of the circumference of the ligament is brought into contact with the serosa of the uterus and hence adhesion and firm suspension occurs only to that extent.

A fourth disadvantage is that the sutures may hold and agglutination occur at the midline of the uterus and not from the midline laterally thus forming a loop of the round ligament through which bowel may herniate or into and through which omentum may herniate and become fixed. And this matter of herniation is also true of the point in the broad ligament through which the round ligament is drawn in bringing it posterior to the uterus.

The modification here described and illustrated obviates these disadvantages. The uterus is grasped by a uterus holding forceps and drawn upward and forward and an incision an inch in length is made in the midline on the posterior aspect of the uterus and with two thirds of the incision below the level of the round ligaments (Fig. 1). A subserosal dissection is then made bilaterally and to a point on the round ligament depending upon the amount of shortening required. The round ligament is then grasped—bilaterally—and drawn medially (see Fig. 2). The two ligaments are then apposed and adjusted for tension and obviation of ante flexion and further that the uterus be not retroflected as though it were thrown over a clothes line. (It is for this reason—that of adjustment—that two thirds of the incision in the serosa shall lie below the level of the round ligaments.) The suspensive mechanism having been thus checked for fault apposition is secured by suture of the ligaments to each other and to the uterus (Fig. 3). The serosal incision is then closed by a subserosal continuous suture.

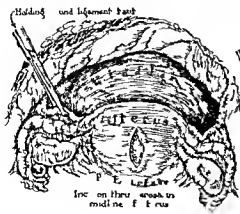


Fig. 1

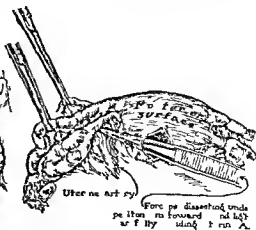


Fig. 2



Fig 3

As illustrated (Fig. 4) the procedure may be applied on either anterior or posterior aspects of the uterus the choice depending upon uterine and extra uterine conditions obtaining in the pelvis.

It is evident that with this modified technique there is no break in the continuity of the peritoneum except at the line of serosal incision and hence an opportunity for the formation of adhesions to the uterus only at that point that there is less danger of the suspension breaking down since agglutination and subsequent fibrous union occurs over the entire circumference of the round ligament and not only over but from one sixth to one third of available area that even though the individual oxidizes catgut very

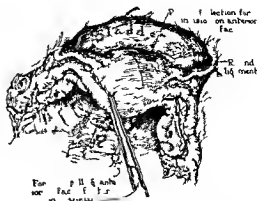


Fig 4

rapidly the suspension is likely to maintain its integrity and last that there is no opportunity for herniation either through a loop of the round ligament or a rent in the broad

Note Since the serosa is sometimes difficult of separation the writer frequently before incision injects a solution of normal saline subserosally in the midline and laterally thus separating the serosa in the midline and along the course of the lateral dissection. The lateral dissection is then simplified and not at all difficult of accomplishment. (This method of separating the serosa from serosa invested organs is to be more fully described in a subsequent article with respect to the gall bladder.)

ONE HUNDRED AND SEVENTEEN CONSECUTIVE CERVICAL CÆSAREAN SECTIONS WITHOUT MATERNAL MORTALITY¹

J P GREENHILL BS MD FACS CHICAGO

Att di gOb t t c Th Ch ag Ly gin R p tal Att d g Gyn c i g st C k County H p tal Asso t Ob t t N thw t U ty M d i al School

RECENTLY I¹ reviewed the histories of all the cervical cæsarean sections which had been performed at the Chicago Lying in Hospital up to July 1 1929. There were 874 conservative cervical cæsarean sections and 21 additional laparotrachelotomies which were followed by amputation of the uterus. The total maternal mortality for the 895 operations was 1.23 per cent and the total fetal mortality was 4.6 per cent. The study proved interesting to me and I decided to learn still more by analyzing my own cases. I found that up to July 1 1930 I had performed 108 conservative and 9 radical cervical cæsarean sections. These operations were performed upon patients encountered in private practice women seen in consultation with other physicians and ward patients cared for at the Chicago Lying in Hospital. In this series there were no maternal deaths but there were 5 fetal deaths (4.3 per cent).

Only the salient features of the 117 operations are given in the present analysis.

PARITY

The parity of the patients is shown in Table I.

INDICATIONS FOR OPERATION

The indications for the abdominal deliveries are shown in Table II.

In many instances there were 2 or more reasons for performing the cæsarean section but in Table II only the most important indication is listed. The incidence of cephalopelvic disproportion namely 47 per cent for this series of cæsarean sections is very low. However since 22 of the 23 patients listed above as having had previous cæsarean sections had contracted pelvis the real

incidence for cephalopelvic disproportion in this series is at least 65.8 per cent. Among the 23 patients who had previously had abdominal deliveries 11 had had laparotrachelotomies 10 had had classic operations and 2 had had both types. Of the 11 patients in the first group 5 were given a test of labor and of the 10 in the second group 3 were permitted to go into labor. Elective operations were performed on the two in the last group.

Cæsarean sections were performed on 11 patients (9.4 per cent) who had toxæmia of pregnancy. This is a relatively large frequency but it is due to the fact that in severe cases of toxæmia without convulsions we believe in emptying the uterus if medical treatment does not produce improvement. In eclampsia the pregnancy is terminated as soon after the first convulsion as possible. The method selected for all patients with toxæmia is the one which is safest for the mother. Cæsarean section is performed for only a small percentage of the cases. We resort to cæsarean section if the patient is a primipara at or near term with an undilated cervix and a floating fetal head. We attempt to use local anaesthesia for all patients with toxæmia regardless of whether delivery is accomplished vaginally or abdominally.

TABLE II—INDICATIONS

| | C | Per cent |
|---|-----|----------|
| Cephalopelvic disproportion | 55 | 47.0 |
| Previous cæsarean sections—test of labor | 8 | 6.8 |
| Previous cæsarean sections—no test of labor | 15 | 12.8 |
| Toxæmia without convulsions | 9 | 7.7 |
| Eclampsia | 2 | 1.7 |
| Placenta prævia | 7 | 6.0 |
| Abruptio placentæ | 5 | 4.3 |
| Cardiac disease | 5 | 4.3 |
| Dystocia dystrophica syndrome | 4 | 3.4 |
| Tumor blocking pelvis | 2 | 1.7 |
| Repeated stillbirths | 2 | 1.7 |
| Goiter toxæmia wearing tracheotomy tube | 1 | 0.85 |
| Previous rupture of uterus | 1 | 0.85 |
| Three almost fatal postpartum hæmorrhages | 1 | 0.85 |
| | 117 | 99.95 |

TABLE I—PARITY

| P ty | C ses | P t |
|-------------|-------|-------|
| Primipara | 58 | 50.0 |
| Secundipara | 38 | 3.5 |
| Tertipara | 9 | 7.7 |
| Quadrupara | 4 | 3.4 |
| Quintipara | 4 | 3.4 |
| Septipara | 2 | 1.7 |
| Nonipara | 1 | 0.85 |
| Undecipara | 1 | 0.85 |
| | 117 | 100.4 |

Hæmorrhage was an indication for operation in 12 cases (10.3 per cent). Seven cesarean sections (6 per cent) were done for placenta prævia and 5 (4.3 per cent) for abruptio placentæ. We prefer the abdominal route for most cases of central or partial placenta prævia if there has been much loss of blood regardless of the condition of the child because the operation is performed in the interests of the mother. When necessary a blood transfusion is given before during or after the operation and local anesthesia is used whenever possible. Some individuals who agree that the abdominal route is the proper one for many patients with placenta prævia prefer the classic operation because they believe that a cervical operation is very complicated if the placenta is encountered before the baby is delivered. We have not found the operations done for placenta prævia much more difficult than usual. We prefer the cervical operation in these cases because we can easily inspect the placental bed. This is an advantage since not infrequently one or more large bleeding sinuses are seen. The bleeding from these can easily be checked by pursestring sutures. In the classic operation these sinuses are not readily detected and the bleeding from them may prove fatal.

All 5 patients who had abruptio placentæ had a severe form of this disease and in 2 of them the uterus presented the typical picture of uteroplacental apoplexy.

The 5 patients who had heart disease were seriously ill and 2 of them were sterilized at the time the cesarean section was performed. We believe that for a certain number of women who have cardiac decompensation during pregnancy laparotomectomy under local anesthesia (and morphin) is a life saving operation.

The term dystocia dystrophica syndrome is applied to a group of troublesome patients whose chief characteristics are as follows. The women are usually heavy set with masculine features. The external pelvic measurements are usually normal but the available space within the pelvis is smaller than normal and the extremities are short. The vagina is narrow and rigid and the cervix is short and firm. The patients have a tendency to develop toxæmia and to go beyond term. The position of the fetus is usually that of an occiput posterior and the fetal head remains above the pelvic inlet even after many hours of labor. When delivery is attempted from below the result is frequently disastrous to the baby and injurious to the mother.

Repeated stillbirths is given as an indication for only two operations. However 17 patients

(14.5 per cent) in this series had previously had 26 dead babies 3 of which had been delivered after craniotomy. Nineteen women (16.2 per cent) gave a history of having had 27 difficult operative deliveries exclusive of cesarean section. The 2 patients who had tumors blocking the pelvis and the 2 who had had repeated stillbirths (due to dystocia) in reality should be added to the group with cephalopelvic disproportion thereby raising the number to 81 (69 per cent).

DURATION OF PREGNANCY

In Table III the duration of pregnancy is listed. It will be seen that 87.1 per cent of the patients were at or beyond full term and that only 3.5 per cent of the operations were performed at the eighth lunar month or earlier.

TABLE III—DURATION OF PREGNANCY

| | Cases | % |
|---------------------|-------|-------|
| More than 10 months | 7 | 4.8 |
| 9/1 lunar m ths | 85 | 7.6 |
| 9/1 nar m ths | 5 | 4.3 |
| 9/1 nar m th | 4 | 3.4 |
| 8/1 m th | 7 | 7 |
| 8/1 month | 3 | 6 |
| 7/1 mo ths | — | 85 |
| | 17 | 99.95 |

DURATION OF LABOR

Of the 117 patients 67 (57.3 per cent) were in labor at the time the operation was performed whereas 50 (43.7 per cent) were not in labor. The duration of labor is shown in Table IV.

TABLE IV—DURATION OF LABOR

| | Cases | % |
|-------------------|-------|------|
| Not in labor | 50 | 43.7 |
| In labor | 67 | 57.3 |
| Less than 2 hours | 7 | 7 |
| 2 to 6 hours | 3 | 3 |
| 6 to 8 hours | 15 | 22.4 |
| 8 to 12 hours | 3 | 4.5 |
| 12 to 24 hours | 9 | 13.4 |
| 24 to 36 hours | 9 | 13.4 |
| 36 to 48 hours | 3 | 4.5 |
| 48 to 60 hours | 2 | 3 |
| 60 to 72 hours | 2 | 3 |

It will be seen that 43.6 per cent of the 67 patients who had labor pains were in labor from 1 to 24 hours 10.3 per cent from 24 to 48 hours and 3.4 per cent from 48 to 72 hours before the cesarean section was performed. An explanation is necessary for the 50 patients on whom a cesarean section was performed without a test of labor. The indications for these 50 operations are given in Table V.

TABLE V—INDICATIONS FOR OPERATIONS
WITHOUT TEST OF LABOR

| | Case |
|--|----------|
| Previous cesarean section | 15 |
| Cephalopelvic disproportion | 12 |
| Toxæmia | 6 |
| Heart disease | 5 |
| Placenta prævia | 3 |
| Eclampsia | 2 |
| Repeated stillbirths | 2 |
| Dystocia dystrophia syndrome | 2 |
| Abruptio placenta | 1 |
| Tumor blocking pelvis | 1 |
| Three almost fatal postpartum hæmorrhage | 1 |
| | <hr/> 50 |

The 15 patients who had had previous cesarean sections represent 65 per cent of the 23 patients who had previously been delivered by the abdominal route. The remaining 8 patients were in labor at the time of operation either because they were given a test of labor or because they entered the hospital after labor pains had begun.

It not infrequently happens that women with contracted pelvis in whom the fetal head is high up and seemingly too large for the pelvic inlet have spontaneous deliveries. For this reason nearly all patients with contracted pelvis are given a test of labor. The 12 women in the present series who were operated upon without waiting for labor pains had in addition to a contracted pelvis the following reasons for the operation before labor began:

1. Secundipara with fibroid uterus breech presentation and previous stillbirth due to dystocia.
2. Primipara with mitral insufficiency dyspnoea and tachycardia.
3. Secundipara 37 years old who had had a stillbirth after hi h forceps delivery. Now overterm and medicinal induction of labor failed three times.
4. Primipara with diabetes mellitus and desire to be sterilized.
5. Primipara with fibroid uterus.
6. Unmarried primipara with marked stricture of vagina.
7. Secundipara who had had previous difficult high forceps operation resulting in stillbirth. Now overterm.
8. Secundipara who had had previous high forceps operation resulting in stillbirth. Medicinal induction of labor failed three times and attempt to induce labor by packing cervix with gauze also failed. Now overterm.
9. Primipara with breech presentation and narrow outlet.
10. Quintipara who had had three previous high forceps operations and one craniotomy.
11. Secundipara who had had previous craniotomy. Could not become pregnant until after trachelorrhaphy.
12. Primipara with contracted outlet.

No special explanation is necessary for the operations performed before labor began on the patients who had toxæmia heart disease pla-

centa prævia eclampsia, repeated stillbirths abruptio placenta and a tumor blocking the pelvis. In both patients who had the dystocia dystrophia syndrome repeated attempts to induce labor medicinally failed the head was definitely overriding the pubis and one patient had previously had three spontaneous miscarriages. The patient who had had three almost fatal post partum hæmorrhages had had two transfusions. Her mother died from postpartum hæmorrhage and likewise one sister.

CONDITION OF MEMBRANES

In 82 instances (70.1 per cent) the membranes were intact and in 31 (26.5 per cent) they were ruptured at the time the cesarean section was performed. In 4 cases (3.4 per cent) this could not be determined with any degree of certainty. The duration of time which elapsed between rupture of the membranes and operation varied from 30 minutes to 71 hours.

ANÆSTHETIC

The kind of anæsthetic used is shown in Table VI.

TABLE VI—ANÆSTHETIC

| | Ca | P | t |
|---------------------------------|-----------|-----------|---------|
| Novocain alone | 75 | 64 | 1 |
| Novocain and general anæsthetic | 8 | 6 | 8 |
| Ether | 20 | 24 | 8 |
| Ethylene | 5 | 4 | 3 |
| | <hr/> 117 | <hr/> 100 | <hr/> 0 |

Novocain alone injected by direct infiltration sufficed in 64.1 per cent and in an additional 6.8 per cent a general anæsthetic had to be added to complete the operation. Ether was used so many more times than ethylene because it was the anæsthetic of choice before we began to employ local anæsthesia. Ethylene was not introduced until after we had begun to use local anæsthesia extensively.

Most of my patients are given a hypodermic of morphin $\frac{1}{4}$ grain and magnesium sulphate 2 cubic centimeters about 15 minutes before the operation is started. Thus far I have not seen any bad effects on the baby and my experience leads me to believe that a baby rarely will show any harmful results from morphin given to its mother unless it is born within 1 to 3 hours after the morphin is injected. The morphin helps allay any fear the mother may have of the local anæsthetic it lessens the pain due to the contractions of the uterus before the baby is delivered and also the pain which may be experienced during the closure of the wound.

STERILIZATION

Six patients (5.6 per cent of the 108) who had conservative cervical cesarean sections were sterilized by means of an operation on the tubes. One patient was a primipara, 1 was a secundipara, 2 were tertiparae, 1 was a quadripara, and 1 a quintipara. Three of the patients were sterilized after their first, 2 after their second, and 1 after the third cesarean section. Sterilization was performed after the first operation for the following reasons. One patient was a quadripara who had had two dead babies following forceps deliveries, one live child delivered by forceps, and two spontaneous miscarriages. The second patient was a tertipara who had mitral stenosis and insufficiency and was decompensated at the time of operation. The third patient was a primipara with a cephalopelvic disproportion and diabetes mellitus and she and her husband requested sterilization. The method of sterilization employed in all the cases was the Madlener procedure which consists of elevating the middle portion of each tube, crushing it gently but firmly with a smooth crushing clamp and then placing a heavy silk ligature in the groove made by the crusher. This operation is simple, rapidly performed, bloodless, and as certain as any other conservative procedure.

To the 6 cases of sterilization with retention of the uterus should be added the 9 Porro operations. These 15 cases represent a sterilization incidence of 12 per cent.

PORRO OPERATIONS

The 9 Porro operations among the 117 operations (7.7 per cent) were performed for the following reasons:

1. A quintipara aged 34 years had had 4 normal deliveries. The indication for cesarean section was mitral stenosis and insufficiency with decompensation during pregnancy. The uterus was amputated because of profuse menstrual periods with severe pain requiring rest in bed.

2. A nonipara aged 33 years had had 8 spontaneous deliveries. The Porro operation was done because the patient had an almost fatal abruptio placentae and the uterus showed the typical picture of uteroplacental apoplexy.

3. A tertipara aged 36 years had had 2 difficult high forceps deliveries. The second terminated in a rupture of the lower uterine segment.

4. A quadripara aged 34 years had had spontaneous deliveries. The operation was performed for abruptio placentae and uteroplacental apoplexy.

5. A quadripara aged 30 years had had 3 spontaneous deliveries, but each was followed by

an almost fatal postpartum hemorrhage. She was transfused twice. There were enormous varicose veins in the vagina and labia. Mother and sister died from postpartum hemorrhage.

6. An undecipara aged 40 years had had 10 spontaneous deliveries. Indication for operation was abruptio placentae and toxæmia.

7. A quadripara aged 38 years had had 3 previous cesarean sections.

8. A quintipara aged 37 years had had 2 previous difficult instrumental deliveries, 2 miscarriages, and 2 cesarean sections.

9. A septipara aged 35 years had had 6 spontaneous deliveries. Indication for cesarean section was central placenta prævia.

The general consensus of opinion is that for the delivery of the baby preliminary to a Porro operation it is better to make the incision in the body of the uterus rather than in the lower uterine segment. The reason given is that the former is more easily and quickly performed. In doing a Porro operation I prefer to make the first uterine incision in the lower uterine segment. After stripping the bladder down part way instead of making a longitudinal incision I make a transverse one high up in the lower uterine segment. This forms the first part of the line of amputation of the uterus. A Porro operation by this method should not require more time than a Porro following extraction of the baby through an incision in the body of the uterus. Since in most cases local anæsthesia can be used if not for the entire operation at least for most of it, time is usually not a very important factor.

MORBIDITY

We consider as morbidity any elevation of temperature to 100 degrees F or above even if recorded only once from the time of delivery until the patient is discharged from the hospital. By this strict standard 58 patients (49.6 per cent) had morbidity distributed as shown in Table VII.

TABLE VII—FEVER

| Range of Temperature | Cases | Per cent |
|----------------------|-------|----------|
| 100 to 101 | 3 | 11 |
| 101 | 3 | 6.5 |
| 101 to 102 | 1 | 8.5 |
| 102 to 104 | 3 | 16 |
| 104 to 108 | — | 8 |
| | 58 | 49.55 |

In 26 of the 58 cases no cause for the elevation of temperature could be determined. A large number of these patients had only a mild or a moderate elevation. In Table VIII are listed the

causes of fever in the 32 cases where the etiology could be ascertained

TABLE VIII—CAUSE OF FEVER

| | Cases | F | Per cent |
|-------------------------|-------|----|----------|
| Infected wound | 11 | 9 | 4 |
| Pyelitis and cystitis | 6 | 5 | 1 |
| Bronchitis | 3 | 2 | 6 |
| Mastitis | 2 | 1 | 7 |
| Pneumonia | 2 | 1 | 7 |
| Lochiometra | 2 | 1 | 7 |
| Sore throat | 1 | 0 | 85 |
| Pentontitis | 1 | 0 | 85 |
| Abscess from hypodermic | 1 | 0 | 85 |
| Bartholin gland abscess | 1 | 0 | 85 |
| Thrombophlebitis | 1 | 0 | 85 |
| Diabetes (?) | 1 | 0 | 85 |
| | 32 | 27 | 4 |

Only 1 of the 11 wound infections was extensive and in this instance the patient refused to remain in the hospital after the eighth day because she insisted she was well enough to be up and about. The relatively large incidence of pyelitis and cystitis in this series of cervical operations and the relationship of these complications to the late toxæmia of pregnancy is discussed in my previous paper. In both cases where pneumonia developed, ether had been used as the anæsthetic. Diabetes is listed as a probable cause of fever only because the latter dropped precipitously after the use of insulin.

STAY IN HOSPITAL

The length of time the patients remained in the hospital is shown in Table IX.

TABLE IX—STAY IN HOSPITAL

| Days | Number of Cases | Percentage |
|----------|-----------------|-------------------|
| 8 | 1 | |
| 10 | 2 | |
| 11 | 9 | 70 cases |
| 12 | 25 | or 59.8% |
| 13 | 14 | |
| 14 | 19 | 98 cases or 83.8% |
| 15 | 3 | |
| 16 | 6 | 28 cases |
| 17 | 7 | or 24% |
| 18 | 2 | |
| 19 | 4 | |
| 20 | 2 | |
| 22 to 28 | 11 | 19 cases |
| 34 | 1 | or 16.2% |
| 43 | 1 | |

It may be seen that 59.8 per cent of the patients left the hospital within 14 days and that 83.8 per cent went home within 18 days. The fact that only 19 patients (16.2 per cent) remained in the hospital more than 18 days indicates that most of the febrile complications were not serious.

FETAL MORTALITY

Since there were no multiple pregnancies the total number of babies born was 117. There were five natal and neonatal deaths making a fetal mortality of 4.3 per cent. Two of the 5 deaths were among the 108 conservative cesarean sections (1.9 per cent) whereas the remaining 3 occurred among the 9 Porro operations (33.3 per cent). However, all of the latter babies were dead when their mothers were admitted to the hospital. All 3 mothers had abruptio placentæ. Since there were only two fetal deaths among the 114 babies who were alive at the time the cesarean section was performed, the mortality for the live babies was 1.8 per cent. One of these babies died shortly after birth, the mother having been in labor 24 hours before the operation was performed. Autopsy failed to reveal anything but œdema and anæmia of the brain. The other baby, a monster, lived only a few minutes. Operation was performed for central placenta prævia.

HEALING OF CERVICAL SCARS

In most of the cases in which a laparotracheotomy was repeated, I removed a piece of scar tissue for microscopic study. I also obtained pieces of scar tissue removed by my colleagues at the Chicago Lying-in Hospital. In a study of 37 of these pieces of scar tissue, Bloom and I (5) found that in most cases the wounds had healed very well and that even in the cases in which the scars were weak anatomically, they withstood the distention produced by pregnancy and the stress of labor. Since the report of our study, I have collected 21 more pieces of scar tissue and these bear out our belief in the strength of the scars in the lower uterine segment. As far as I know, there has not been a single case of rupture of the uterus not only after my own 108 laparotrachelotomies but also after the entire series of almost 1,000 cervical operations performed at our hospital up to July 1, 1930.

ADVANTAGES OF THE LAPAROTRACHELOTOMY

The cervical cesarean section has the following advantages over the classic operation. It has a lower mortality and a lower morbidity; it may be performed with safety after a relatively long test of labor and it guarantees a much greater protection against rupture of the uterus in subsequent pregnancies and labors.

Our technique has been described in other reports (1, 2, 3) but I should like to emphasize the added advantages of using local anæsthesia not only for most conservative laparotrachelotomies but also for Porro operations.

SUMMARY

In a series of 108 conservative cervical cesarean sections and 9 Porro operations after laparotrachelotomy there were no maternal deaths. Fifty eight of the patients were primiparæ and 50 were multiparæ.

The chief indications for the operations were cephalopelvic disproportion 47 per cent previous cesarean sections with test of labor 68 per cent previous cesarean sections without test of labor 12.8 per cent toxæmia without convulsions 7.7 per cent eclampsia 1.7 per cent placenta prævia 6 per cent abruptio placenta 4.3 per cent cardiac disease 4.3 per cent and dystocia dystrophica syndrome 3.4 per cent. In reality the total incidence of patients with cephalopelvic disproportion was 69 per cent.

Only 57.3 per cent of the patients were in labor at the time of operation and reasons are given for performing the operation on the 43.7 per cent who were not in labor.

The membranes were ruptured in 26.5 per cent of the cases at the time the operation was performed and the interval of time varied from a half hour to 71 hours.

Direct infiltration anæsthesia alone was used in 64.1 per cent of all the cases in an additional 6.8 per cent a general anæsthetic was used with local anæsthesia either was employed in 24.8 per cent, and ethylene in 4.3 per cent of the cases.

Sterilization was performed in 5.6 per cent of the 108 conservative cases and if the 9 Porro

operations are added the incidence of sterilization was 12 per cent.

A temperature of 100 degrees F or above was noted in 49.6 per cent of the cases and the chief causes in the cases in which the etiology was known were as follows: infected wound 9.6 per cent pyelitis and cystitis 5.1 per cent bronchitis 2.6 per cent mastitis 1.7 per cent pneumonia 1.7 per cent and lochiometra 1.7 per cent.

In 59.8 per cent of the cases the patients left the hospital within 14 days and in 83.8 per cent they went home within 18 days.

The total fetal mortality was 4.3 per cent but of the 5 deaths 3 occurred before the operation was performed. In these 3 instances the mothers had abruptio placenta. Of the 2 remaining babies 1 was a monster associated with placenta prævia.

In most instances the wounds of the cervical cesarean sections healed very well as proved by a microscopic study of pieces of scar tissue removed at the time of repeated laparotrachelotomies.

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NOTE.—Since submitting this paper I have added 1 additional conservative cesarean section without maternal or fetal mortality hence the total number of operations is 110 and the total fetal mortality is 3.6 per cent.

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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OCTOBER 1931

PALLIATION IN CANCER

A NUMBER of articles have appeared recently in the literature directing attention to the medical treatment of cancer from the standpoint of palliation. These articles have been timely because of the tendency to consider cancer in its various stages as either hopeless or curable. The fact has been overlooked that great relief of symptoms and prolongation of life can often be afforded the patient with incurable cancer by treatment directed to these ends.

The medical treatment of cancer has been more or less neglected by the profession because the merit of any method of treatment has been judged solely on the basis of permanency of cure. Sufficient consideration has not been given the effect of such methods in the control of distressing symptoms particularly in the alleviation of pain. The various colloidal substances notably lead (introduced by Blair Bell), arsenical preparations, tissue extracts and irradiation are or may be of palliative value and as such are worthy of continued investigation. If it is true that non-surgical treatment of cancer lessens suffering and prolongs life, the medical

profession has been remiss in not judging methods of non-surgical treatment on their merits in this respect rather than in respect to cure.

From a surgical standpoint increasing experience emphasizes the value of palliative measures. In cancer of the gastro-intestinal tract for example it is not uncommon to find that after removal of a primary malignant lesion in cases in which known irremovable metastasis exists the patient has been completely restored to general health, has lived in perfect comfort for a surprising length of time and has then succumbed suddenly to invasion of other organs by neoplastic disease. This fact however should not minimize the importance of the widest possible removal of the growth and regional lymphatics.

No better example can be found of the value of palliative measures than in the surgical treatment of cancer of the stomach. It is unfortunately true that in many cases the disease has already extended beyond the possibility of cure when first seen by the surgeon. In such cases however the extirpation of the primary growth in the stomach, with removal of the adjacent lymph nodes is often possible and frequently completely changes the clinical picture. Obstruction when present or impending is not only relieved but the patient is protected against the development of any subsequent obstruction provided the duodenal stump has been closed and a modified Billroth II type of operation is done. The patient's ability to take adequate nourishment means restoration of weight and general well-being and extension of life in comfort is accomplished when other

wise the patient would have succumbed to gradual obliteration of the gastric cavity and all the distress which it entails

W J Mayo early directed attention to the fact that patients may live 2 3 or 4 years in apparently perfect health following removal of a cancer of the stomach when metastasis was known to be present at the time of the operation This is particularly true when the metastasis is in the liver since this organ permits extensive invasion if gradual and not accompanied by infection without apparently affecting health

A significant possibility in such intentionally palliative operations for cancer in any stage and in any situation is that cure may result when the accessible lymph nodes are removed even if inaccessible nodes are involved There is reason to believe that cures may occur under such circumstances and this possibility demands consideration of those methods of treatment which might aid in preventing or controlling further extension

For example is it possible that lead even though not suitable for the treatment of lesions of the gastro intestinal tract because of necrosis of the involved tissues might be used after a primary growth is removed in the hope of hanging about a higher percentage of cures? The value of irradiation as an adjunct to surgical removal is as yet not definitely proved but its further development should establish its usefulness in this respect

Finally in palliation the treatment of the patient is of paramount significance Few are so constituted as to accept with equanimity a diagnosis of cancer This being true it is the duty of the physician whenever possible to adhere to first precepts that is to alleviate suffering even if this entails withholding knowledge of his condition from the patient unless it becomes absolutely necessary or

advisable to the best interests of the patient Innumerable examples attest the wisdom of such practice As Sir Fredenck Treves has said In the face of misfortune it is merciless to blot out hope To create hope adds immeasurably to the happiness of the patient and consequently contributes to the prolongation of life and prospects of cure

DOVALD C BALFOUR

THE INTERDEPENDENCE OF PATHOLOGIST AND SURGEON

THERE is little doubt that dependence upon laboratory methods of diagnosis is a tendency in medicine which has been carried to dangerous extremes but there is likewise little doubt that at least one phase of laboratory science has not been sufficiently emphasized or to put it more correctly has not been sufficiently utilized Examination of tissues by the pathologist is a practice with which at least in theory every physician is in hearty accord but which he is inclined to overlook in the complicated routine of his life and in the face of the inconvenience which it often involves And yet times without number his patient's health his patient's life hang upon the observance of this simple precaution

I am moved to speak strongly on this subject to urge the importance not only of the routine examination of all tissues but also of their complete examination because of a tragic experience I have recently undergone Some months ago I operated on a young woman for a simple adenoma of the thyroid as I thought which was grossly benign and which on immediate and deferred microscopic study was reported back to me as microscopically benign Eight months later she returned with an inoperable malignancy of the gland which involved the larynx and

all adjacent structures. The pathologist, in checking back the specimen submitted to him at the first operation found that malignancy had existed then that the proper number of sections had been made but that in some unaccountable way those areas of the specimen which exhibited the malignancy had not been examined at all. He has a careful technician, he is a competent and a conscientious pathologist. I have relied on his judgment many times in the past and yet this irreparable mistake was made.

If this sort of thing can happen with a competent pathologist it is easy to conceive of the tragedies which can result if he is careless or incompetent. The contention of Cullen, Bloodgood and others that the surgeon should be his own pathologist by no means solves the problem. That he should have a comprehensive knowledge of gross pathology that he should have at least a superficial knowledge of microscopic pathology are facts beyond dispute. But that he should possess the detailed knowledge of histopathology essential for the diagnosis of the borderline case and the early case, the cases which confuse and bewilder the most expert is for the average man simply out of the question. If he possessed such knowledge the chances are that he would be a pathologist, not a surgeon, or that hoary age would overtake him before he had mastered both specialties.

In all but the most exceptional cases the surgeon must depend upon the pathologist must accept his decisions, must base his course of action upon them, and only a surgeon, and a conscientious surgeon at that, realizes how much is at stake every time he calls him into consultation. The conscientious pathologist on the other hand is equally aware of the responsibilities he carries, knows full well that the outcome of very

many cases is quite as much in his hands as in the hands of his surgical associate. It follows therefore that he must be a highly trained man and an exceedingly careful man for an untrained or a careless pathologist is the most dangerous of all conscienceless physicians. He should be—though he often is not—a well paid man for a cheap pathologist is the falsest of all false economies. He must be a studious man for his branch of medical science does not stand still. These are exacting standards but we cannot afford to lower them on their strict observance the issues of life and death hinge.

The ideal of course is such a laboratory group as that headed by Lwing or that headed by MacCarty, distinguished leaders of distinguished followers but such groups can scarcely be duplicated in the world certainly not in the average hospital. The best that we can do therefore is to use to the fullest the laboratory facilities at our command to supplement them and round them out as circumstances, particularly financial circumstances permit, and to insist that the personnel of the department include only trained and competent men. The real efficiency of any hospital is measured by the efficiency of its pathological laboratory. We can likewise insist that this department be located either within the operating suite or so closely adjacent to it as to be an integral part of it so that the examination of specimens can be done without loss of time without undue prolongation of the anesthesia without the confusion which a request for immediate diagnosis only too often produces in the average hospital. We can insist that the pathologist or a competent assistant be within call every time surgery is done, the calls of the surgical staff constitute the emergencies of the laboratory just as a ruptured appendix or a fractured skull or a gunshot wound con-

stitutes the emergencies of the surgeon. We can insist that all specimens removed at operation regardless of location regardless of gross appearance regardless of the desires of the surgeon or the wishes of his patient be sent to the laboratory for examination and that a system be in effect which makes such a routine inevitable. We can insist that specimens not only be examined routinely but can insist that they be examined comprehensively as well so that such a tragedy as the one I have just recounted cannot possibly occur.

If we do these things if we teach our internes and our nurses the importance of

doing these things we can comfort ourselves with the thought that however limited our facilities may be our patients are adequately protected against carelessness and against error at least as far as human precautions can protect them. For in malignancy of any type the most expert treatment avails nothing in comparison with the importance of an accurate diagnosis and an early diagnosis. And such a diagnosis because it is possible only by the microscope and by the trained eye is the responsibility of the pathologist almost more than it is the responsibility of the surgeon who submits the specimens to him.

URBAN MAES



J COLLINS WARREN
184 -1927

MASTER SURGEONS OF AMERICA

JOHN COLLINS WARREN

ON the third day of November 1927 there died in Boston Massachusetts a surgeon whose life and whose works were of such a character as to entitle his memory to far more than ordinary consideration and respect This surgeon was Dr John Collins Warren

He came of distinguished ancestry and belonged to a line of eminent doctors of five successive generations reaching far back to Revolutionary times

1 His great grandfather Dr John Warren (1753-1815)—younger brother of General Joseph Warren (also a doctor) who at the head of the American forces fell at Bunker Hill—was a hospital surgeon in the Revolutionary Army and was the first professor of anatomy and surgery in Harvard College He was one of the founders of the Harvard Medical School and also of the Massachusetts Medical Society He was furthermore a prominent citizen deeply interested in public affairs

2 His grandfather Dr John C Warren (1778-1856) was also in turn professor of anatomy and surgery at Harvard and with Dr James Jackson took an active part in the founding of the Massachusetts General Hospital which was first opened in 1821 He it was who at the hospital in 1846 gave the first public demonstration of the use of ether as a surgical anæsthetic—removal of a tumor of the neck—Dr William T G Morton himself being the anæsthetist

3 His father Dr Jonathan Mason Warren (1811-1867) was one of the surgeons at the Massachusetts General Hospital and he also took a prominent part in the surgery of his time in Boston

4 Dr John Collins Warren, was of the next generation and following him came

5 His son Dr John Warren who was associate professor of anatomy at Harvard and also University marshal from 1911 until the day of his death July 17 1928

The subject of this sketch Dr John Collins Warren—or as he was in the habit of writing his name J Collins Warren —was born in Boston May 4 1842 and was the son of Dr Jonathan Mason Warren as already related and his wife Annie (Crowninshield) Warren

John Collins Warren acquired his early education at the Boston Latin School

and later attended a private school in the same city. He graduated from Harvard College in 1863 from the Harvard Medical School in 1866 and then after taking a course at the Jefferson Medical College in Philadelphia continued his studies in Europe for about 3 years—principally in London and Edinburgh Paris Berlin and Vienna.

On his return to Boston he at once began the practice of his profession and was soon appointed surgeon to out patients at the Massachusetts General Hospital. He served in that institution for 36 years being promoted from one grade to a higher one until finally he became senior visiting surgeon.

Being desirous of teaching as well as practicing surgery he fortunately soon received an appointment as instructor at the Harvard Medical School and thereafter he was rapidly advanced through the various grades until he became Moseley professor of surgery finally retiring with the title of professor emeritus. His wide experience both in the practice of surgery and in teaching naturally increasing as time went on added greatly to his efficiency in both of these directions. His private practice and his consultations also grew in accordance.

He was a prolific writer on many different surgical subjects. One of his earliest successes in this respect was the winning of the prize in 187 for his Boylston medical essay on Rodent Ulcer. Throughout his professional life he was always intensely interested in surgical pathology and he was one of the first in this country to employ systematically the microscopic examination of pathological material removed at operation. Everything relating to malignant tumors particularly appealed to him and he wrote many papers on this subject. In 1895 he published a book entitled *Surgical Pathology and Therapeutics* embodying the most approved ideas of that time. This book has been called his most notable literary accomplishment. Later he contributed the chapter on Surgical Pathology in Keen's *American Text Book of Surgery* still later with Pearce Gould the well known English surgeon he became co editor and in part author of the *International Text Book of Surgery* which was published in two volumes. For a number of years he was also editor of the *Boston Medical and Surgical Journal*.

He was a Member of the American Surgical Association and at one time President he was one of five upon whom honorary fellowships were conferred by the American College of Surgeons at its first meeting he was a member of the American Medical Association of the Massachusetts Medical Society and of the College of Physicians of Philadelphia. He was also chairman of the Harvard Cancer Commission for nearly 25 years. For more than 12 years he was also president of the Massachusetts Eye and Ear Infirmary.

He had unbounded faith in the unusual opportunities in Boston for the extensive development of medical teaching and research and a large part of what has been accomplished in this direction was due to him. He was always

intensely interested in the welfare of the Harvard Medical School and was ever ready to help it in every way possible, and his work for the School continued over many years was unremitting and of enormous benefit. He, with Dr Henry P Bowditch not only originated the ideas upon which the plan of the present Harvard Medical School was planned but together they did notable work in securing the necessary funds for carrying their ideas into effect and in attracting to the vicinity a number of hospitals and other institutions allied in one way or another to medicine and thus developed what up to that time was new and was much needed in Boston—a great Medical Center. This result was largely due to Dr Warren's persistent exertions and to his firm conviction as to the worthiness of his cause. To him also belonged the credit for making it possible to build the Collis P Huntington Memorial Hospital and to equip it for work in the study and treatment of cancer. He moreover directed his efforts toward securing for medical students suitable dormitory accommodations and before he died he had the satisfaction of knowing that this dream had become true in the building of Vanderbilt Hall.

He was awarded an Honorary LL D from Jefferson Medical College (in 1895) and later the same from Harvard and also from McGill. In 1900 he received the honorary degree of fellowship in the Royal College of Surgeons of England and somewhat later a similar honorary degree in the Royal College of Surgeons of Edinburgh.

As might be expected Dr Warren had also many interests outside of medicine among them being the Massachusetts Historical Society to which by will he left forty six volumes of the papers of the Warren family for five generations (from Revolutionary times). He was also a member and past president of the Bunker Hill Monument Association and of the Humane Society of Massachusetts and a fellow of the American Academy of Arts and Sciences. From 1908 to 1914 he was an Overseer of Harvard University.

Such is a mere outline of the life and activities of the man who did such memorable service for Harvard University for the Harvard Medical School, and for medicine and surgery. It has been said of him by an intimate friend most competent to judge that he was one of the few men whose background and foreground were in perfect accord for not only did he belong to a distinguished family but what he himself stood for and what he himself accomplished were worthy of a prominent place in the history of that family. While occasionally the possession of distinguished forebears seems to discourage initiative in some of the younger members of a family nevertheless in other instances it appears to act as a definite stimulant. This latter was probably true in Dr Warren's case. With such a thought in his mind it is easy to see how he dreamed dreams and how he later experienced what must have given him the keenest pleasure not only in seeing his dreams realized but in possessing the knowledge that he had

done his full share in changing them into actual being. And yet modesty was a marked characteristic of Dr Warren for his thoughts seemed to be directed principally toward what there yet remained for him to do rather than toward what he had already done.

One cannot close this short sketch without reference to Dr Warren's attractive personality which came with it a suggestion of the old school. Although so often deeply engrossed in serious thoughts for the betterment of one medical interest or another he possessed a genuine gaiety of spirits, was a prince of good company, and was beloved by all who knew him.

In recognition of his notable services there was placed after his death in the Warren Museum at the Harvard Medical School a marble bust of him by the sculptor Paramino. There it may be seen—a fitting tribute to his memory—in the honorable company of his distinguished ancestors!

GEORGE H. MONKS

NICOLAI MASSÆ

VENETIARTIVM ET MEDICINÆ

DOCTORIS EPISTOLÆ MEDICINALES ET

Philosophicæ eleg nissimæ ad omnes fere morbos nuperrime editæ,
in quibus quamplurima scitu digna de o dinandis intentionibus in
consultationibus et collegijs inter medicos Accurandis sine
cul ribus morbis et in anatomis dissectionibus Ac etiam
de diætetica et philosophicis rebus dubijs quædam cons
scripta sunt ut studioso lecto patebit Opus sane
non tantum medicis suadens et perutile
verum etiam si diosus omnibus alijs

Nicolaus Rontana Brasiliensis ad lectorem

Abdita sacratæ medicinæ discere quicquid
Optant præferri utile ea pat opus

Insuasela Dea sunt rem collig omniaq
Consilio cum sit qui lenet omne malum



Ne quis impune libellum hunc imprimere
audeat Privilegiis cautum est

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

ALFRED BROWN M D F A C S OMAHA

THE LETTERS OF NICOLA MASSA

SURGICAL progress during the sixteenth century is inseparably linked with the increase in anatomical knowledge which was gained during that period. Consequently though their surgical skill may not have been great one must accord to the anatomists of the period considerable credit for advances made by others in surgery and surgical technique. The great change in anatomy was made by Vesalius who through the agency of Jan Stephan Kalkar a pupil of the great artist Titian raised anatomical illustration from the cave man type of art of the broadside and fugitive sheet to an art comparable to the best then known and so gave to the world an accurate visual image of the construction of the human body. Many of the points to which Vesalius called attention by his illustrations and accompanying text had been moot questions for years among anatomists who did not have the genius of Vesalius for demonstration and had called attention to them by the written word only and had neglected the most important visual image.

Nicola Massa was one of these pre-Vesalian anatomists who lived in Venice during the early part of the sixteenth century and died there according to Gurli about 1569. His published works were on many subjects and his work in anatomy and surgery fell rather in the background possibly because his work on syphilis which disease was then attracting much attention proved so popular that it went through four editions in thirty one years. His *Anatomy* published first in 1536 four years after his book on syphilis bore the title *An Introductory Book of Anatomy* and his letters *Epistolæ Medicinales* appeared in its first edition six years later in 1542.

Massa's anatomical knowledge was considerable and the fact that he was not given proper credit for it disappointed him greatly and he laid the blame for this at the door of illustration in anatomy. He wrote two letters with reference to anatomy to his friend Antonio Francanzano of Pavia. In the first one dated January 20 1543 he calls attention to his previous descriptions of the membranes of the brain the gray and the white matter and the olfactory lobes of the brain with their nerves to the nasal mucous membrane and attributes to them the sense of smell. In the second letter dated January 23 1543 he again refers to the nasal nerves and also refers to his discovery of the nerves to the muscle

of the tongue both of which he demonstrated by first macerating the tissues. He says: "For the tongue substance (as I have said) evidently does not lack nerve parts mixed with flesh to its final part as one can see from the passage of filaments which proceed through the fleshy substance which are demonstrated especially when they (the tissues) are macerated and have become almost putrid or when they have been stewed or cooked in much water."

He thus antedated many of the discoveries which were published and popularized later by the anatomists of the Vesalian school and those who came shortly after. In retrospect it would seem that his disregard of illustration had a good deal to do with the lack of appreciation of his work.

Massa did not stop with the cranial nerves in his anatomical research. He noted vessels probably lymphatics passing upward from the orifices of the renal vessels. He differed in his description of the liver from the previous conception of a multilobed organ as depicted in the fugitive sheets and described the liver as consisting of two lobes separated by an incomplete septum.

Massa's most important anatomical contribution so far as its bearing on surgery is concerned was his description of the peritoneum and the technique of evisceration. This is contained in his *Introductory Book of Anatomy* published in Venice in 1536 1559 and 1594. After describing the technique he proceeds to the surgical side of the question. He advised washing intestines protruding through a wound with warm wine then enlarging the wound and replacing the gut after the wounded intestine is sutured. An interesting point is that in his abdominal operations he used metal retractors. He says after describing how the wound is enlarged with a blunt pointed instrument "which instrument the best operators add the fingers or plates of silver or brass. He differs from Hippocrates dictum that wounds of the small intestine are always fatal and after reading his description of his technique of intestinal suture one can see that barring infection his patient had a good chance to recover."

Massa did not have much use for contemporary illustrated anatomical works and as the letter in which he refers to them was written in January 1543 he probably means the Vesalian plates published in 1538 for neither the *Epitome* nor *Fabrica* had then been published. Great anatomist and surgeon as he was he overlooked the value of illustration.

REVIEWS OF NEW BOOKS

THE fifth edition of Lovett's book, as revised and edited by his colleagues and successors Ober and Brewster, Their purpose is to perpetuate the fundamental contributions of their illustrious teacher. The etiology, diagnosis and treatment of Lovett's work on scoliosis is of great practical importance. Some new valuable material which includes the Galeazzi method of treatment and detailed descriptions of the turnbuckle jacket and the turnbuckle shell treatment has been added. This book is the best book on the subject at the present time. It is highly recommended to medical and physical education student, physical therapists, pediatricians and orthopedic surgeon.

PHILIP LEVIN, M.D.

LIEPMANN'S book on gynecology is a really thoughtful and of producing a really useful textbook for physicians as well as students. The reader is at once most favorably impressed by the fact that the work does not follow the orthodox and too often uninteresting form of the average text book but rather is written in a most informal and interesting manner. The entire subject of gynecology is covered in fifteen lectures each on one field of this specialty in addition to two lectures on the economic, social and psychological aspects of gynecology. The book is written in the intimate style which characterizes all of Liepmann's publications and is most admirably and profusely illustrated. He presents case histories having to do with every type of gynecologic pathology and in the subsequent discussions brings up all of the newer and recognized developments in gynecology such as perturbation, hysterolapngraph, Aschheim-Zondek tests etc.

The author has been one of the pioneers in Germany in the development of Soziale Frauenkunde for which there is no English equivalent phrase but which includes a study of psychology, sociology and economics as they pertain to gynecology together with a study of birth control, contraception and sterility plus fertility. The two chapters covering these subjects should be of interest to American gynecologists as they present so completely the results of the German studies along these lines as well as the present German views.

Liepmann has tentatively omitted all discussion of radiation technique as he feels that this belongs to radiology, a specialty in itself. He has omitted practical, all illustrations of microscopic studies—for the reader is referred to standard textbooks on pathology. He has also given no bibliography although he quotes freely from the literature past

and present. For bibliography the reader is referred to the larger works on gynecology such as Halban, Setz, etc. If more of the modern German authors could adopt this attitude and thus do away with the constant repetition of cumbersome bibliography which at best are incomplete, more of the textbooks from Germany could be kept down in size and price and thus be more usable than at present. Liepmann's *Seminar* is complete and yet has been kept within what should be normal size and price. It is a volume in which all gynecologists should be interested.

RALPH A. REIS, M.D.

RALPH A. REIS, M.D.

THE atlas on the anatomy of the ear by Belou consists of a collection of loose leaflets 236 in all representing illustrations of the anatomy of the organ of hearing placed on cards and many of them are arranged for study with the stereoscope. The volume represents a comprehensive pre-entailment from illustrations of d sections of the complicated structures which comprise the organ of hearing. What text there is in Spanish but the illustrations of the d sections need very little text as they speak for themselves. GEORGE W. SHAMM FOR M.D.

GEORGE W. SHANN UGM M.D.

KAPLAN set forth in his excellent work a manual of the indications, technique and results of radium therapy as practiced at Bellevue Hospital. Holfelder's method of cross fire irradiation, the partitioning into small repeatedly administered doses of roentgen irradiation according to Solomon and Regaud's method of employing small doses of radium heavily filtered over a considerable period of time all find their expression in the author's practice. On the whole in spite of the brevity of the text the book constitutes a very satisfactory guide to radiation therapy not only in cancer but in the rather numerous benign conditions in which radium and the roentgen rays have proved of value.

IMES T C SE MD

THE second half of volume five of *Vets Handb* *ch der Gynäkologie* is a 750 page volume written by Ludwig Nuernberger of Halle on the Diseases of the Vagina. The work is encyclopedic in character and includes practically everything that has been written on the physiology and pathology of the vagina. It is in outline form and very simply written. The illustrations are good.

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many of them being in color but portions of the book are inadequately illustrated. There is a marked overemphasis of the sections on physiology the sections on laboratory procedures and the sections dealing with the theoretical discussions. On the other hand the portions of the book which are devoted to the clinical aspects of the diseases of the vagina might have been elaborated upon and more completely written. This is true of the handling of the sections on therapy throughout the book and especially true of the discussion of the treatment of malignant tumors of the vagina—to the reader this leaves much to be desired. However the volume being so nearly complete and containing as it does a full bibliography of the world literature on the subject should make an excellent reference work on diseases of the vagina. In this respect this volume is in keeping with the two volumes of this series previously reviewed. The author has made this volume a handy one to use as a reference work because in addition to the complete bibliography at the end of the volume the references to the text are found at the bottom of each page. RALPH A REIS MD

*An Introduction to Gynecology*¹ is exactly what its name implies. The book was written primarily for third year medical students and is an outgrowth of a series of notes which the author has used for some time. The book is well written each subject being presented simply clearly and briefly—so briefly in fact that many chapters seem incomplete even for third year students. This work with supplementary reading should prove to be a desirable and usable book for students.

RALPH A REIS MD

The Michons have presented a very practical exposition of their experience in the diagnosis and treatment of diseases of the genito urinary tract in their recent book on urology. The book is designed as a critical analysis and summary of an extensive personal experience without reference to the literature or the discussion of methods not acceptable to the authors. The book is well illustrated and there are some points in surgical technique which appear unique and original. VINCENT J O CONOR MD

*The pattern after which textbooks of pathology have been compiled has not been materially changed since it was established by Matthew Baillie's Morbid Anatomy in 1793. The present volume The Pathology of Internal Diseases*² by William Boyd professor of pathology in the University of Manitoba is a definite attempt to break the cake of custom which has interfered with the potential usefulness of pathological material for clinical teaching. This

volume is neither a textbook of pathology nor one of internal medicine but it bridges the gap between these two subjects. It should stimulate the interest of practitioners of medicine in postmortem examinations. It will also point the way by which pathologists may become effective clinical teachers. Pathology is a science in itself and worthy of study for itself alone but pathology as a pure science has little interest to either the practitioner or the medical student. It is only when pathology is brought into definite relations with clinical medicine that the internist and general practitioner will take a real interest in the subject much to their own and their patient's advantage.

Dr Boyd's book is well calculated to stimulate such interest. The subject of pathology is taken up according to organs and systems of organs so that the bare skeleton outline does not differ materially from the outline of the ordinary textbook of special pathology. That which especially distinguishes the book is the inclusion under the discussion of each of the various pathological lesions described of one or more paragraphs detailing the relation of symptoms to lesions. Thus after describing clearly and without unnecessary verbosity the pathological changes which accompany a disease the author explains how these pathological changes give rise to the symptoms and physical signs by which the disease manifests itself clinically.

To the pathologist this volume should bring a new point of view and enable him to engage more effectively in the highest type of clinical teaching. To the internist it should be a constant reminder that symptoms and physical signs rest upon a foundation of pathologic change and that he can still learn much at the autopsy table if he approaches it in a state of mind which this volume should produce in him. To the medical student it should be a useful aid in filling the gaps that the ordinary textbooks leave vacant. J P SIMONDS MD

*Reed's Book*³ is the first in English to be devoted to obstetric work done on the manikin. It is well written and easy to read. The various steps in each maneuver are explained minutely. The author feels that since labor is becoming more and more a pathological process this book will fill a need. It is intended as a guide for the undergraduate who aims to do general work but it is likewise useful for the specialists. It is a useful textbook.

E L CORNELL MD

*This treatise by Lacassagne*⁴ is an excellent and concise statement of radiotherapy at the Radium Institute of Paris. The treatise may be divided into two parts first the general mechanics of radium with brief reference to biological effects and second

A I T C T V G By C J F M B M D St
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N h I G D T C 93
T R P U LOG INTE D KA E By W L m B yd M D
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N Is & Sons 93

At the end of each chapter is a bibliography citing authoritative articles on each subject discussed. As Butlin's *Diseases of the Tongue* was the best text book on the subject and as it has been out of print for 30 years this book will no doubt meet with a well merited reception. H A PORTS MD

THE book¹ on brain tumors by Ernest Sachs is the first attempt on the part of a neurological surgeon to present the surgery of intracranial tumors in a volume suited to the entire medical profession. All of the contributions to the advancement of neurological surgery so many of which have come from this country have been in the form of monographs upon special topics in this field of surgery.

Dr Sachs' task was a difficult one but he has succeeded admirably in presenting his material in a concise manner. He would be the first to admit that his book does not cover each group of intracranial tumors completely. As a matter of fact monographs have been written upon one particular group of intracranial tumors in one particular location. The average doctor however is not inclined to obtain the information he desires about intracranial tumors from a group of monographs. Consequently this book will serve a very definite need and will be one of the means of acquainting the practitioner with what may be accomplished in the treatment of intracranial tumors.

ECKSTEIN'S biography of the great Japanese scientist Hideyo Noguchi depicts the splendid achievements of this remarkable Oriental bacteriologist with his Oriental point of view dropped suddenly into the turmoil of Occidental surroundings. It is a narrative of great discoveries beginning with serological studies of snake venom and continuing logically to syphilis, poliomyelitis, yellow fever, verruga peruana, Rocky Mountain spotted fever and trachoma together with other investigations less striking but hardly less important. It is admirably told in a manner that reflects the restless genius of Noguchi. A I KENDALL MD

ASHHURST has displayed sound didactic instinct in laying emphasis on the underlying principles of pathogenesis, diagnosis and treatment in the fourth edition of his *Surgery*² which has been

brought up to date by a thorough revision of its subject matter and inclusion of such new matter as has accumulated in recent years. It is a thoroughly satisfactory textbook of surgery for both students and practitioners. The reviewer is impressed by a certain freshness and vigor of style reflecting as it does the wide personal experience of the author both as a surgeon and as a frequent contributor to surgical literature. GEO HALPERIN MD

THE popularity of Romanis and Mitchiner's *Science and Practice of Surgery*⁴ is attested by its third appearance within the past years. It is a work in two fairly large volumes. The subject matter is divided according to the usual plan into two divisions: that of general surgery and that of systemic surgery. It is a valuable contribution to the already somewhat long list of textbooks on surgery and in its revised edition embraces much of what is new in science and practice. GEO HALPERIN MD

AFTER a historical review of our knowledge of pancreatic neoplasms the authors of *Cancer du Pancréas* express the view that the almost hopeless results of surgical intervention or interventions are due to a belated diagnosis. Therefore improvement is to be sought in earlier diagnosis through the means of functional tests. There are chapters dealing extensively with the anatomy and physiology of the organ with the question of frequency, etiology and pathogenesis of pancreatic cancer. The chapter dealing with the histological study of pancreatic neoplasms is beautifully illustrated. There is an excellent discussion of various clinical forms, their symptoms and mode of evolution. Cancers of the head are separated from those of the tail forms accompanied by simple glycosuria are separated from those accompanied by hyperinsulinism or by hypoglycemia. Various functional tests are evaluated in the chapter on diagnosis.

Surgical treatment is the only one capable of holding out some hope. Total removal of the organ is contraindicated on physiological grounds because it inevitably leads to a grave pancreatic diabetes. The technical difficulties are great and the immediate mortality is high. A rather exhaustive bibliography completes this excellent monograph. GEO HALPERIN MD

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M D N P O C T O L O G Y By M o C P t t M D
I R C P S (Ed) F R C S (Ed) F A C S St L o
Th C v M by C m p y 193

T H E C A U S A T I O N O F C O N I C G A S T R O D I S E A S E S
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(E g) L R C P (L o d) W t h I t r d c t n b y S
I I m p h y R l l e t n B a t G C V O K C B N e w Y o r k
a d L o d o O f d U r s t y P r e s 93

L E C E H A L I T I S L E T H A R G I C A I T S S E Q U E L E A N T r a t
n t By C t t n o n E c o o m T l i d b y K
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D I S E A S E S O F T H E G U M S A N D O F T H E M E M B R A N E
S K n t h G d b y K B E M R C S L R C P
D P H (C t b) 4 t h d N w l k a d L d O f o r d
U t y P e s 93

T R A U S O F T H E J A W S By R b e t H I y M D

D D S F A C S a n d L w e n c e C t s A B M D
D D S P h i l d e l p h a L e & F b g 93
G Y N C O L O C T E C H I U R G I C A L E By C S b C
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W H A T T H E P U I C S H O U L D K o O U T C H I L D S T I
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M d w t C o m p t v 93

A N N U A L C L I N I C A L R E P T O F T H E G O V E N N E N T H
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L E T R A M E N T C H I R U R G I C A L D S O M O L A T E S B A
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A d e t C e 193

T H E D I A G N O S I S A N D T R E A T M E N T O F V E N E R E A L D I S E A S E S
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H S P I T A L V N A L D I S E A S E S D E P A R T M E N T By L W
H r D S O M B C h B F R C P F W t h C h a p
t o T h e M e d c o l g a l A p e c t t By F G C A
h k M D F R C P t 4 t h d N w l k d
L o d O f o d U t y P 93

CORRESPONDENCE

IS CANCER OF THE BREAST FOUND MORE OFTEN IN MARRIED WOMEN THAN IN UNMARRIED WOMEN?

I t h e E d t T h a t c n c e r o f t h e b e a s t i s f o u n d
m o s t e n m a r r i e d t h a n i n u n m a r r i e d w o m e n s e e m s
t o b e t h e g e n e r a l o p i n i o n a n d s o e x p r e s s e d i n a
t i t l e i n t h e M a y 193 i s s u e o f t h i s j o u r n a l b y D r
J o h n G S t u b e n b o r d i n A n A n a l y s i s o f O n e H u n
d r e d d e f i n i t e C a s e s o f C a n c e r o f t h e B r e a s t
f r o m t h e F s t S u r g c a l D i v i s i o n o f N e w Y o r k H o s p
i t a l S e r v i c e o f D r C h a r l e s L G b s o n t o w h o m t h e
p o p o l a t i o n o w e s o m u c h f o r h i s t e a c h i n g s e p e c i a l l y
i n t h e d e v e l o p m e n t o f t h e f o l l o w u p s y s t e m o f s u r
g c a l p r o c e d u r e s

I a n u m b e r o f y e a r s I h a v e b e e n g n i n g t h e
i m p r e s s i o n t h a t c a n c e r o f t h e b r e a s t v a r i e s r e l a t i v e l y m o r e
c o m m o n p r o p o r t i o n a l l y i n s i n g l e t h a n i n m a r r i e d
o m e n o f t h e c a n c e r a g e y e t I h a d n o a c c u r a t e
r e c o r d t o s u p p o r t m y i m p r e s s i o n H o w e v e r f r o m a
s t a t i s t i c a l s t u d y o f c a n c e r o f t h e b r e a s t i n P e n n
s y l a n i a b y D H B W o o d p u b l i s h e d i n t h e
M e d c o l J i l l d R e c d D e c e m b e r 5 9 8 w e
h a v e v a l u a b l e d a t a

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w e r e 666 470 f e m l e s o v e r 35 y e a r s o f a g e

M o s t c a r e f u l l y c o m p l e d v i t a l s t a t i s t i c s o f t h e
S t a t e o f P e n s y l a n i a f o r 1927 s h o w t h a t t h e r e
w e r e 810 d e a t h s f r o m c a n c e r o f t h e b r e a s t i n w o m e n
6 i n m e n T h e w e r e 130 d e a t h s f r o m c a n c e r o f t h e
b r e a s t i n s i n g l e o m e n o v e r 35 y e a r s o f a g e g i v i n g

a d e a t h r a t e o f 100 p e r 10 000 t h e e v e r y 678 d e a t h
f r o m c a n c e r o f t h e b r e a s t a m o n g m a r r i e d w o m e n
w i t h a d e a t h r a t e o f 44 p e r 100 000 C a n c e r o f t h e
b r e a s t i n s i n g l e o m e n v a s t h e r f o r e n e r l t h r e e
t i m e s m o r e p r e v a l e n t i n P e n n s y l a n i a t h a n a m o n g
m a r r i e d w o m e n

I t i s e s t a m e d t h a t a p p r o x i m a t e l y 7 p e c e n t i f
t h e w o m e n o f P e n n s y l a n i a o v e r 35 y e a r s o f a g e
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c a n c e r d e a t h r a t e s A s t h e d e a t h s f r o m c a n c e r o f
t h e b r e a s t i n t h i s s e r i e s o f c a s e s w e r e t w o a n d n e
h a l f t i m e s m o r e p r e v a l e n t p r o p o r t i o n a l l y a m o n g t h e
w o m e n w h o w e r e s i n g l e t h a n a m o n g t h o s e w h o h d
b e e n m a r r i e d I t i s e v i d e n t t h a t l a c t a t i o n h a s n o
i n f l u e n c e o n t h e p r o d u c t i o n o f c a n c e r

I n a p a p e r o f m y o w n P r o g n o s i s o n C a n c e r o f
t h e B r a s t i n t h e N e b r a s k a S t a t M e d c a l J i l l
J u l y 1929 I c a l l e d a t t e n t i o n t o D r W o o d s l e n
s y l a n a s t a t i s t i c a l r e p o r t M y o n o p i n i o n i s t h a t
t h e n a t u r a l f u n c t i o n i n g b r e a s t o f t h e m a r r i e d
w o m a n i s l e s s l i a b l e t o c a n c e r t h a n i s t h a t o f t h e
u n m a r r i e d w o m a n b e c a u s e a s t h e b r e a s t o f t h e
l a t t e r n e v e r h a s f u n c t i o n e d a s n a t u r a l l y i n t e n d e d s e n s i
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f e r t i l e f e l d s f o r c a n c e r g r o w t h s h a t e v e r m a y b e
t h e e x c i t i n g c a u s e s

I t i s t o b e p r e s u m e d t h a t t h e p r o p o r t i o n a l n u m b e r
o f s i n g l e t o m a r r i e d o m e n i n P e n n s y l a n i a i s o n
t h e w h o l e f a i r l y a c c u r a t e c o n d i t i o n i n t h e m a j o r t y
o f o u r p o p u l a t i o n a n d m a y b e t a k e n a s m o r e t h a n
p r o b a b l e g u i d e i n a r r i v i n g a t a n a n s w e r t o t h e q u e s
t i o n o f t h e t i t l e o f t h i s c o m m u n i c a t i o n

O m h a N e b r a s k a J E S U M M E R S M D

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

C. JEFF MILLER NEW ORLEANS *President*

ALLEN B. KANAVEL CHICAGO *President Elect*

FRANKLIN H. MARTIN *Director General*

CHARLES GORDON HEYD *Chairman New York Committee*

JOHN E. JENNINGS *Chairman Brooklyn Committee*

COMPLETE PROGRAM FOR THE 1931 CLINICAL CONGRESS

CLINICAL CONGRESS PROGRAM IN BRIEF

All sessions at Waldorf Astoria except as noted

Monday, October 1

- 9 30 Hospital conference
- 2 00 Clinics in the hospitals
- 2 00 Hospital conference
- 2 00 Surgical film exhibition
- 8 15 Presidential meeting

Tuesday, October 13

- 9 00 Clinics in the hospitals
- 9 30 Hospital conference
- 9 30 Surgical film exhibition
- 2 00 Clinics in the hospitals
- 2 00 Hospital conference
- 2 00 Surgical film exhibition
- 8 00 Hospital conference
- 8 15 Scientific session on general surgery
- 8 15 Section on otolaryngology—Academy of Medicine

Wednesday, October 14—Brooklyn: Long Island Day

- 9 00 Clinics in the hospitals
- 9 30 Surgical film exhibition
- 9 30 Hospital conference
- 2 00 Clinics in the hospital
- 2 00 Surgical film exhibition
- 2 00 Hospital conference
- 2 00 Conference on Teaching in Surgery
- 8 00 Public meeting in Brooklyn—Academy of Medicine
- 8 15 Scientific session general surgery
- 8 15 Section on ophthalmology—Academy of Medicine

Thursday, October 15

- 9 00 Clinics in the hospitals
- 9 30 Conference on Cancer Clinics
- 9 30 Surgical film exhibition
- 9 30 Hospital conference—Brooklyn
- 2 00 Clinics in the hospitals
- 2 00 Hospital conference—Brooklyn
- 2 00 Annual meeting of the College
- 3 00 Symposium on Cancer
- 8 15 Scientific session general surgery

Friday, October 16

- 9 00 Clinics in the hospitals
- 9 30 Surgical film exhibition
- 9 30 Conference on Traumatic Surgery
- 12 00 Meeting of new Fellows
- 2 00 Clinics in the hospitals
- 2 00 Conference on Traumatic Surgery
- 2 00 Surgical film exhibition
- 8 15 Convocation

THE surgeons of New York and Brooklyn have prepared for the twenty first annual Clinical Congress of the American College of Surgeons beginning Monday October 12 and ending Friday October 16 a comprehensive program of clinics and demonstrations in their hospitals and medical schools that will completely represent the clinical activities of that great medical center in all departments of surgery. The program as published in the following pages should be considered only as an outline of the clinical program for the five days session. The real program of the Congress will be issued daily in the form of bulletins. These will be posted at headquarters at the Waldorf Astoria each afternoon presenting in detail the schedules for all hospitals for the following day. Printed bulletins containing the same material and with complete programs for the scientific sessions, conferences etc. will be distributed each morning.

It will be noted that the program provides for operative clinics and demonstrations in the hospitals beginning at 2 o'clock on Monday afternoon and continuing during the following four days with clinics both morning and afternoon.

The Committee on Arrangements has provided for special fracture clinics in several of the hos-

pitals at which the methods employed and the results obtained in the treatment of fractures will be adequately demonstrated. Another important feature of the clinical program is to be found in the series of clinics at which the newer methods for the treatment of cancer by surgery, radium and X-ray will be demonstrated. Also the program includes special clinics for the demonstration of methods employed in the rehabilitation of persons injured in industrial accidents including the surgical treatment and physical therapy.

Wednesday has been designated as Brooklyn Long Island Day and for that day special importance attaches to the program of clinics in the hospital of Brooklyn and the Long Island suburbs. A program of clinics and demonstrations that includes many interesting features has been arranged by the Brooklyn and Long Island surgeons as published in the following pages.

Special meetings of the sections on ophthalmology and otolaryngology of the New York Academy of Medicine have been arranged for Tuesday and Wednesday evening at the Academy through the courtesy of the officers of those sections in co-operation with sub-committees headed by Dr. Conrad Berens and Dr. Richard T. Atkins. Practitioners in these two specialties attending the Clinical Congress are invited to attend these special meetings for which programs have been prepared as printed in the following pages.

An exhibition of surgical films both talking and silent including some in color will be conducted at headquarters daily. Motion picture films that have been produced under the sponsorship of the Board on Medical Motion Pictures of the College will be exhibited together with a number of outstanding contributions not included in the College library of films.

At the annual meeting of the College on Thursday afternoon beginning at 2 o'clock in the ballroom of the Waldorf Astoria formal reports on the activities of the College will be presented by the officers and the several standing committees. Election of officers for the ensuing year will follow. At the conclusion of the annual meeting there will be a symposium on cancer at which the scientific aspects of the problem will be presented.

EVENING MEETINGS

In the following pages will be found the complete programs for the five general evening sessions as arranged by the Executive Committee which meetings will be held in the ballroom of the Waldorf Astoria Hotel. On Monday evening at the Pre-idental Meeting following the introduction of distinguished guests from abroad the re-

turning president Dr. C. Jeff Miller of New Orleans will give a brief address and introduce the president elect Dr. Allen B. Kanavel of Chicago. The John B. Murphy oration in surgery will be delivered by Mr. Arthur H. Burges of Manchester, England, professor of clinical surgery in Victoria University and past president of the British Medical Association.

The fellowship address at the annual convocation on Friday evening will be given by Dr. James R. Angell, president of Yale University. At that session the 1931 class of candidates for Fellowship in the College will be received.

Dr. William Darrach, professor of clinical surgery in Columbia University, will present the annual oration on fractures at the session on Wednesday evening.

Among the distinguished visitors from abroad who will attend this year's Congress in addition to those whose names appear on the program of evening meetings are Professor Hans von Haberer of Cologne, Germany; Dr. Jose Govanes, director of the National Institute for the Study of Cancer, Madrid, Spain; and chief of National League against Cancer and Sir G. Lenthall Cheate, surgeon to King's College Hospital, London.

COMMUNITY HEALTH MEETING

As a part of the program for Brooklyn Long Island Day on Wednesday the Executive Committee of the Congress has arranged for a public meeting in the Brooklyn Academy of Music at 8 P.M. at which addresses on subjects of popular interest will be presented by a number of outstanding men. The program will be found in the following pages. Dr. John I. Jennings, Chairman of the Brooklyn Committee on Arrangements will preside.

CANCER CONFERENCE AND SYMPOSIUM

Under the auspices of the Committee on the Treatment of Malignant Diseases a round table conference will be held in the ballroom of the Waldorf Astoria on Thursday morning with Dr. Burton J. Lee of New York presiding. Papers and discussions presented at this conference will deal with the organization and administration of cancer clinics in general hospitals, cancer hospitals and institutes.

In the afternoon following the annual meeting of the College a symposium on cancer under the auspices of the same committee will be presented. Programs for these two sessions are as follows:

Monday, September 9, 1931

Administration of a Cancer Clinic at General Hospital
CHARLES A. DUKES, M.D., Oklahoma City

Reference of Hospital Patients to the Cancer Clinic
 CHANNING C SIMMONS M D Boston
 Role of the Social Service Worker in the Cancer Clinic of
 a General Hospital MISS ELEANOR KELLY Boston
 Character of Conferences of the Cancer Clinic Staff
 EDWARD J KLOPP M D Philadelphia
 Importance of Nomenclature in Cancer Clinics WILLIAM
 C MCCARTY M D Rochester Minn
 Radium Containers and the Custody of Radium EDWIN
 C ERNST M D St Louis
 Uniformity of Cancer Records LOUIS I DUBLIN Ph D
 New York
 Value of Diagnostic Cancer Clinics BURTON J LEE
 M D New York

Afternoon Session 3 30

Report of the Committee on the Treatment of Malignant
 Diseases ROBERT B GREENOUGH M D Boston
 The Role of Education in the Cancer Campaign CLARENCE
 C LITTLE Sc D New York
 Plans for the Radiological Work at the California Insti-
 tute of Technology SEELEY O MUDD M D and
 CHARLES C LAURITSON Ph D Pasadena Calif
 Newer Developments in X-Ray Therapy of Cancer
 RALPH E HERENDEEN M D New York
 The Value of Radiation in the Treatment of Breast Car-
 cinoma SIR G LENTHAL CREATHE K C B CVO
 FRCS London
 Treatment of Carcinoma of the Colon SIR CHARLES
 GORDON WATSON K B E C M G London
 Surgery in Cancer DONALD C BALFOUR M D Rochester
 Minn

CONFERENCE ON INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

An all day conference under the auspices of the
 Board on Industrial Medicine and Traumatic
 Surgery with Dr Frederic A Besley Chairman
 of the Board presiding will be held in the ball
 room of the Waldorf Astoria on Friday at which
 the following program will be presented

Morning Session 9 30

Summary of the Year's Activities FRANKLIN H MARTIN
 M D Director General Chicago
 Traumatic Surgery Clinic for Small Industries HART E
 FISHER M D Chicago
 Ethylene as an Anesthetic in Traumatic Surgery DONALD
 GUTHRIE M D Sayre Pa
 Importance of the Follow Up Clinic GROVER C PEN-
 BERTHY M D Detroit
 Operative Treatment of Unilateral Fractures of the
 Femoral Condyles and Tibial Tuberosities WILLIAM
 R CURBINS M D Chicago
 Some Methods of Reducing Industrial Accident Severity
 J J WITTMER M D New York
 Spondylolisthesis HENRY W MEYERDING M D Roches-
 ter Minn
 Local Anesthesia as a Factor in Reducing the Morbidity
 of Traumatic Surgery LIEUTENANT COMMANDER
 MORTON WILLIAMS M C USN Great Lakes Ill
 The Admissibility of the Early Return to Work of the
 Injured WILLIAM L ESTES JR M D and L A
 SHOUY M D Bethlehem Pa
 The Prevention of Shock and Trauma During the Trans-
 portation of Surgical Cases by Field Traction Splint-
 ing COLONEL WILLIAM L KELLER M C USA
 Washington

Afternoon Session 2 00

Convalescent Home as Applied to Medical Work in In-
 dustry CASSIUS WATSON M D New York
 The Industrial Accident Case—A Plea for Expert Indus-
 trial Surgery with Better Recognition by Heads of
 Industry and the Medical Profession WILLIAM R
 McCLEURE M D Detroit
 Economic Readjustment Following Head Injuries TEM-
 PLE FAY M D Philadelphia
 Labor's Interest in Industrial Medicine and Traumatic
 Surgery EDWARD F McGRADY Representative
 American Federation of Labor Washington
 Attitude of Medical and Surgical Section of the American
 Railway Association toward the Program of the Amer-
 ican College of Surgeons DANIEL WILLARD Presi-
 dent Baltimore & Ohio Railroad Baltimore
 Our Recognition of the Importance of Organization for the
 Care of Men and Women in Large Industries EDWIN
 F CARTER Vice President American Telephone and
 Telegraph Company New York
 My Interest in the Care of Men and Women in Industry
 ALFRED E SMITH New York

CONFERENCE ON GRADUATE AND UNDER GRADUATE TEACHING IN SURGERY

Eminent teachers and clinicians of the United
 States and Canada will contribute to a symposium
 dealing with methods of graduate and under
 graduate teaching of surgery which will be pre-
 sented on Wednesday afternoon at 2 o'clock at
 the Waldorf Astoria The program is as follows
 Teaching of Surgery FRED C ZAPFFE M D Chicago
 ELLIOTT C CUTLER M D Cleveland
 Discussion by WILLIAM J MAYO M D Rochester Minn
 Medical Education IRVING S CUTLER M D Chicago
 Graduate Teaching JOHN S RODMAN M D Philadel-
 phia GEORGE J HEUER M D Cincinnati LOUIS B
 WILSON M D Rochester Minn GEORGE P
 MULLER M D Philadelphia

HOSPITAL STANDARDIZATION CONFERENCE

An interesting program of papers round table
 conferences and practical demonstrations dealing
 with problems related to the hospital standardiza-
 tion program of the College has been prepared for
 the fourteenth annual hospital conference which
 opens at 9 30 on Monday morning in the grand
 ballroom of the Waldorf Astoria The program
 for the annual conference has been planned to
 interest surgeons hospital trustees executives
 and nurses The College extends an invitation to
 attend the conference to all persons interested in
 the hospital field

Monday—9 30 A M—12 00 M

Chairman's address The Obligation of the Hospital to the
 Internic Staff C JEFF MILLER M D New Orleans
 Social Ideas in Hospital Service ALLEN B KANAVAL
 M D Chicago
 Present Program of the American College of Surgeon
 FRANKLIN H MARTIN M D Chicago
 Findings from the 1931 Hospital Standardization Survey
 MALCOLM T MACEachern M D Chicago

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A Pl f the Sy tem t I t t n d S p ol
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D ll P
D n T D GHTS OAN MD New y k

T d y - 9 30 M o m

Op F rum A J SWAN ON To t pr d g
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M d l S c l W k I d str l M d c e d T m t c
Surgery LOU SE C ODENCRANTZ New y k
D uss JANET T O N T O N N y k
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by BUR O V J LE MD New y k

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D s Ho R D E B O S y r P
H w c S c i n t f i c C l n l R e c o r d B A s s e d (U
t a t d) J A M E S T N v M D N w O l s
D F I L I P H K U S C H E R MD Chicag
A C h k S y t m l C r t C l c a l R d D o r o t h
G I L M A N S e a t t l W a s h
D s E E Y N M V E U R G N w y k
A P l f E f f i c t F H U p d S t d y f E d R e l l
G E O R G E G R A V W A R D MD N w y k
D sc I N w y k L L MD Lo s l l e
A P l f M s u g S g I R e l t s n th Comm ty
H o s p t l C L F B L A C MD J k I l l
D s T I O M A S R I O N O N MD A g u t G

P M 5 00 P M

R d T b l C f e M d a l r s g d m u tra
t d c m c p b l m C d c t d by R C
B u l r MD M d W n d R B E J O L L Y
Ho t T

B kly - T l s d y - 9 30 A t 00 M

D m t r a t o d d t b l c n f e s d t e d by
MALCOLM T MAC L A I N MD Chicag a d
ROBERT JOL H t T ss t e d by p
t e d t a d h d f d p t m t f h p t al
P o c e e d s d m u t d d s h a g g p t n t s
g t l m n g m t f i th c
p r t m t r s g d m u t t d o p r a t
g m m g m n t d p c d g a t
d m a m t f i th t r n s e

P M 4 00 P M

Dem strat n a d r o d t b l o n f e s d t e d by
Ro RT JOLLY H st T v s d M LCOLM T

MACACHERN M.D. Chicago assisted by superintendents and heads of departments of hospitals Organization and management of the dietary department and food service business methods in hospitals management of the obstetrical department handling of hospital visitors public relations

HEADQUARTERS

General headquarters for the Clinical Congress will be established at the new Waldorf Astoria Hotel located on Park Avenue between 49th and 50th Streets. This magnificent new hotel with more than 2,000 guest rooms which will open October 1 affords unusual facilities for sessions of the Clinical Congress. The grand ballroom and other large rooms and foyers on the second floor of the hotel have been reserved for the exclusive use of the Congress for scientific meetings conferences film exhibitions registration and ticket bureaus bulletin boards executive offices scientific and technical exhibitions etc. All the comforts and facilities of the old Waldorf Astoria which had been headquarters on the occasion of three previous Congresses will be found in the new hotel with many added attractions and conveniences.

Space has been reserved in the Astor Gallery, Jide Room and other large rooms and foyers on the second floor of the hotel adjacent to the grand ballroom for the Technical Exhibition in which will be represented the leading manufacturers of surgical instruments X-ray apparatus operating lights hospital apparatus of all kinds pharmaceutical publishers of medical books etc.

LIMITED ATTENDANCE—ADVANCE REGISTRATION

Attendance at the New York Brooklyn session will be limited to a number that can be comfortably accommodated at the clinics the limit of attendance being based upon the result of a survey of the amphitheaters operating rooms and laboratories in the hospitals and medical schools to determine their capacity for accommodating visitors. Under this plan it will be necessary for those who wish to attend to register in advance.

Attendance at all clinics and demonstrations will be controlled by means of special clinic tickets which plan provides an efficient means for the distribution of the visiting surgeons among the several clinics and insures against overcrowding as the number of tickets issued for any clinic will be limited to the capacity of the room in which that clinic will be given.

A registration fee of \$3.00 is required of each surgeon attending the annual Clinical Congress such fees providing the funds with which to meet

the expenses of the meeting. To each surgeon registering in advance a formal receipt for the registration fee is issued which receipt is to be exchanged for a general admission card upon his registration at headquarters. This card which is non transferable must be presented in order to secure clinic tickets and admission to the evening meetings.

NEW YORK HOTELS AND THEIR RATES

There are many first class hotels in the Grand Central Terminal district within easy walking distance of the Waldorf Astoria the headquarters hotel. The following hotels are recommended by the Committee on Arrangements.

| | M m m t S gl w th D ll nom or m | | | |
|--------------------------------------|---------------------------------------|-------|------|--|
| Ambassador Park Ave a 151st St | \$7.00 | \$ | 0.00 | |
| Barclay 111 East 48th St | 6.00 | 10.00 | | |
| Biltmore Madison Ave and 43rd St | 6.00 | 10.00 | | |
| Chatham Vanderbilt Ave and 48th St | 5.00 | 8.00 | | |
| Commodore 42nd St and Lexington Ave | 3.50 | 7.00 | | |
| Cladstone 114 East 52nd St | 4.00 | 6.00 | | |
| Lexington Lexington Ave and 48th St | 3.50 | 6.00 | | |
| Montclair Lexington Ave and 49th St | 3.00 | 5.00 | | |
| New Weston Madison Ave and 50th St | 5.00 | 8.00 | | |
| Park Lane 299 Park Ave | 7.00 | 8.00 | | |
| Ritz Carlton Madison Ave and 46th St | 7.00 | 10.00 | | |
| Roosevelt Madison Ave and 45th St | 5.00 | 7.00 | | |
| Shelton Lexington Ave and 48th St | 3.00 | 4.00 | | |
| Waldorf Astoria Park Ave and 50th St | 7.00 | 10.00 | | |

REDUCED RAILWAY FARES

The railways of the United States and Canada have authorized reduced fares on account of the New York session of the Clinical Congress so that the total fare for the round trip will be one and one half the ordinary first class one way fare. To take advantage of the reduced rates it is necessary to pay the full one way fare to New York, procuring from the ticket agent when purchasing ticket a convention certificate which certificate is to be deposited at headquarters for the signature of the general manager of the Clinical Congress and the vise of a special agent of the railways. Upon presentation of a vised certificate to the ticket agent in New York not later than October 20 a ticket for the return journey by the same route as traveled to New York may be purchased at one half the one way fare.

In the eastern central and southern states and eastern provinces of Canada tickets may be purchased between October 8 and 14 in other sections of the United States and Canada at earlier dates. The return journey from New York must be begun not later than October 20 to be completed within thirty days from date of sale of going ticket.

The reduction in fares does not apply to Pullman fares nor to extra fares charged for passage on certain trains. Local railroad ticket agents will supply detailed information with regard to dates of sale rates routes etc. Stop-overs on both the going and return journeys may be had within certain limits.

Full fare must be paid from starting point to New York and it is essential that a convention certificate be obtained from the agent from whom the ticket is purchased. These certificates are to be signed by the general manager of the Clinical Congress and vised by a special railroad agent at Clinical Congress headquarters in New York on or before October 16. No reduction in railroad fares can be secured except in compliance with the regulations outlined and within the dates specified. It is important to note that the return trip must be made by the same route

as that used to New York and that the certificate must be deposited at headquarters during the meeting and return ticket purchased and used not later than October 20.

An exception to the above arrangement is to be noted in the case of persons traveling from points in certain far western states and British Columbia who will be able to purchase round trip summer excursion tickets which will be on sale up to and including October 15 with a final return limit of October 31. The summer excursion fare is somewhat lower than the convention fare mentioned above but the former is available only in certain of the far western states and British Columbia. Tickets sold at summer excursion rates permit traveling to New York by way of a direct route and returning by way of another direct route with liberal stop over privileges.

BROOKLYN COMMUNITY HEALTH MEETING

ACADEMY OF MUSIC - WEDNESDAY 8 00 P M

JOHN E. JENNINGS M D Brooklyn Presiding

The American College of Surgeons FRANKLIN H. MARTIN M D Director General Chicago

Marvel of Modern Medicine ALLEN B. KANAVEL M D Chicago

Choosing Your Hospital MALCOLM T. MACEachern M D Chicago

What You Should Know about Cancer JOSEPH C. BLOODGOOD M D Baltimore

Prevention of Health in Industry FREDERIC A. BESLEY M D Waukegan Ill

Medicine in the Future GEORGE W. CRILE M D Cleveland

Your Personal Responsibility for Health C. JEFF. MILLER M D New Orleans

Aiding Yours to Your Life CHARLES H. MAYO M D Rochester Minn

The Role of the Hospital in Human Salvage ROBERT JOLLY Houston Texas

PROGRAMS FOR EVENING MEETINGS

GRAND BALLROOM WALDORF ASTORIA

Presidential Meeting—Monday 8 15 P M

Addresses of Welcome CHARLES GORDON HEYD M D Chairman New York Committee on Arrangements
and JOHN E JENNINGS M D Chairman Brooklyn Committee on Arrangements

Introduction of Foreign Guests

Address of Retiring President Medical Men and Their Lay Critics C JEFF MILLER M D New Orleans

Inaugural Address Fundamentalism and Social Progress in Medicine ARLEV B KANAHEL M D Chicago

The John B Murphy Oration in Surgery Murphy and Some Principles of Urinary Surgery ARTHUR H
BURGESS M B F R C S Manchester England

Tuesday 8 15 P M

The Present Status of Cardiac Surgery ELLIOTT C CUTLER M D Cleveland

The Operative Approach to the Heart and Pericardium ARTHUR M SHIPLEY M D Baltimore

Technique and End Results in Denervation of the Adrenal Glands GEORGE W CRILEY M D Cleveland

Wednesday 8 15 P M

The Newer Concept of Chronic Arthritis RALPH PEMBERTON M D Philadelphia

A New Method of Operating for the Repair of Ruptured Cruciate Ligaments of the Knee Joint WILLIAM
R CUBBINS M D Chicago

Fracture Oration Some Old Truths about Fractures WILLIAM DARRACH M D New York

Thursday 8 15 P M

Peritoneal Adhesions Their Prevention by the Use of Digestive Ferments ALTON OCHSNER M D and
EARL GARSIDE M D New Orleans

Further Experiences with Fascial Repair of Hernia W EDWARD GALLIE M D Toronto

Curability of Cancer of the Stomach DONALD C BALFOUR M D Rochester Minn

Some Experiences in the Treatment of Carcinoma of the Rectum with Radium SIR CHARLES GORDON
WATSON K B E C M C F R C S London England

Conto ation Friday 8 15 P M

Invocation

Conferring of Honorary Fellowships

Presentation of Candidates for Fellowship Class of 1931

Presidential Address The Program of the College and the Initiates Responsibility ALLEN B KANAHEL
M D Chicago

Fellowship Address Medicine and the Contemporary Social Order JAMES R ANGELL Ph D Litt D
LL D President Yale University New Haven Conn

SURGERY OF THE EYE EAR NOSE AND THROAT

NEW YORK ACADEMY OF MEDICINE

Tuesday 8 15 P M

An Outline of the Activities of the Otological Research Laboratory of the Johns Hopkins University during
the Last Five Years S J CROWE M D Baltimore

Some Intimate Studies of Nasal Function Their Bearing upon Diagnosis and Treatment ARTHUR W
PROETZ M D St Louis

Wednesday 8 15 P M

Symposium on Injuries to the Eye and Orbit

Clinical Aspects EDWARD B HECAEL M D Pittsburgh GEORGE H CROSS M D Chester Pa E S
SHERMAN M D Newark and H S MILES M D Bridgeport Conn

Pathological Aspects BERNARD SAMUELS M D New York

Compensation in Eye Injury Cases V A ZIMMER Director of Workmen's Compensation New York

Prevention of Injury to the Eye LOUIS H CARRIS Managing Director of the National Society for the
Prevention of Blindness New York

PRELIMINARY CLINICAL PROGRAM

GENERAL SURGERY GYNECOLOGY OBSTETRICS ORTHOPEDICS UROLOGY
PROCTOLOGY SURGICAL PATHOLOGY ETC

CLINICS IN NEW YORK HOSPITALS

MEMORIAL HOSPITAL

Monday

H I MARTIN and MR ELLIS— Pract cld mo st a
t f prt bopsy ftum r
B S B R I C —21 Impl t t n of d m i c n
f the bl l l
B S B R R N C R A I DEAN J a d i S FERGUSON—
3 Ind es l t i th t eat m nt f anc f th bl d
l a c f th pr t t d t e t m a f th t e t
th h b t n f e a e

Tuesday

W I HEALY—9 R d ium p p l c t i n f o c e r f t r u
W P H I l a d F R SMITH—9 30 L d r s l t n
n f th ut r u
E I I Q IMBY—30 Meth d f d t e m a t n of
the m nt f ad a t o n d e l d t a s p e c f i d u m
F I A d I d D R PARK— New s a c o m s
m e l n m a
R I H R R N C —33 Ro at g n a y t e t m e n t of
t i l l u m P b o e
F W ST —4 L h b i t o n f p e c m e n s f e
g a m a a n d m h a n s

Wednesday

D I C S O U H I C M R I N n d D R WATSON—9
C n m f t h m u t h p h a r y n x a f f r y n d u m
p p l t n p a t p o e d u e s a n d e d u i t s
f i l l —3 Th n e e d f o p n z d a c c l i c
I C R —3 I n t t m e t o f l y m p h a c m H d g
k n d a n d l u k m a w t h h b t n f e a s

Thursday

B J I F A I F I A D A R —9 I t t i t a l d t e r n a l
p p h t o f d m f a c t m f t h e b r a t
D H I C —9 P r e t i d e m t a t o f H i f m a n
p u c h b p y
B J I F A I F I A D I R — E d s l t n c a o m
f t h b e a t
G L B N L E Y — R a d i a t i o n t h e p y o f a n c r o f t h
e c t u m m p l n t o f g l i r d n s d
W B C O L E Y d B L C O L E Y —3 S m m a r y o f m t h d
f i g n d t e t m t o f b n t u m o p g
l e d n d l i s
F W S E A R T —43 I t h i g y f l o n t m r s
v r —D a y h b t n f r o e i g n r y d e p t m e t
r i m l e m t p e k d e p a t m t G I E l t c 900 000
v l c r a y m a h a d e n t t t e t m n u t

BEEKMAN STREET HOSPITAL

Tuesday

R O E R T K E N E Y d H H Y —9 I s a t e l n c

Wednesday

R L I C P —9 O p e r a t e h e r n i a c l c

Thursday

W W A T T S d W S I F T —9 O t h p d c p e a t o s

Friday

S G M U N D M A G E R I F O B E R T F I N D L A —9 F r e t r e y d

FIFTH AVENUE HOSPITAL

Monday

B E N J A M I N S B R I C E R a n t i f f —2 U r l o g e l p
t o n a i d e m t a t o f s

Tuesday

F E D E R I C W B A N C R T —9 D d l l e p e r a t n
C H A R L E S F T N N T —1 M e d i c a l t e a m t f d d l
l
F E E R C W B A O T — S r g e l t t m t o f l
d l u l c
I E W I S C C O L E — I a d l o k l d g i f l u l l
u l c

F R A N C S H I L D — P e n a t i c l
L T O P S L I Z E A U X a d s t a f f — D m o s t t f d
l e r o o m t e l n q u e

Wednesday

D O N L D C O R D O N —9 F a t u e c l n c t a t m e t f f r a
t u g n r a l h p t i
B B P A L M E d M W C A R — D n t a l p r p h y
t e t t f f c e d j w

Thursday

A J N L E R B E R T S —9 A b d o m a l o p t b c t
l i g a l s t u e o f m l n d f t e d p t l e t y
I A N C E S S I L — C y n e l g a l i y c l s t l y
W I L L I A M L S N E — O t h p l p e r a t n a d m n
t t n f e
I O N S L O I Z E A U X a d s t a f f —2 D e n s t a t o f d e
l e r y m t e c h q u
F E D E R I C W B A N C R T — D y l e C a c e r f t h e
l a g l l g l t a t m t n d f o l l w p
R O B E R T E P O U N — R d o l g a l d g
o f t h l a g e b w e l

Friday

F R E D E R I C W B A N C R T d M S T A L E Y B R O —9
G n l u g e l p a t n s d m n t t o i p o t
p t e t h m l n d m b l m

HOSPITAL FOR RUITURED AND CRIPPLD

Tuesday

C A L G B L R C K n d s t a f f —9 H r o p e a t
A M I A G W H I T M A n d s t f f — D r y e l c A d d l
t m e n t f f a t e f t h e c k o f f m

Wednesday

F F W I C K B R E A M I N a d t f f —9 H p t
W I L I A M B C O F F d B R A D L E Y C L E Y — D y l e
B n s a m a s

Thursday

P E R C Y W R O E S W L L I M L S N E D a d s t a f f —9 O
t h p e d e c l n
J O H N J M C W H O T E R —2 I t h o l g e l d m t r a t n f
b n t u m o s

Friday

W I L I A M L S N E R a n d s t a f f —9 O t h p d c p a t n s

NEW YORK POST GRADUATE HOSPITAL

Monday

FRED H. ALBET—2 Orthopedic surgery
 GEORGE ANOPOL—4 30 Orthopedic clinic

Tuesday

J. EASTMAN SHEEHAN—9 Treatment of keloidal scars eyelid ectropions facial burns cancer disfigurements
 E. W. PETERSON—9 Pediatric surgery
 JOSEPH F. MCCARTHY CLARENCE G. BANDLER STANLEY R. WOODRUFF JOSEPH A. HYAMS J. SYDNEY RITTER SAMUEL E. KRAMER and C. TRAVERS STIFFA—9 Demonstration of the new radio arc method of prostate and prostatic bar excision newer technical methods in the diagnosis and therapy of seminal vesicular conditions
 MORTIMER N. HYAMS—10 Demonstration of conization of the cervix
 WALTER T. DANNEUTH—2 Gynecological operation
 THOMAS RUSSELL—2 Spinal anesthesia
 JOHN F. FIDMANN—2 30 General surgical operations
 CHARLES OGILVY—4 30 Orthopedic surgery

Wednesday

F. P. DE CAUX M.R.C.S. L.R.C.P. London England
 DR. WIDENBORN Freiburg, Germany J. DRYSDALE BUCHANAN and CHARLES GORDON HEYD—9 Dry clinic The laboritursates and basal narcotics compressions on the lung from various surgical positions the spinal curve and ether anesthesia the lithotomy position demonstration of the new Karl Connell apparatus investigations to minimize the explosive risk of ethylene
 F. W. PETERSON—9 Pediatric surgery dry clinic
 W. W. LASHIER—11 Traumatic surgery
 CHARLES GORDON HEYD—2 Operations Hemiotomy cholecystectomy thyroideotomy appendectomy
 Staff—4 Symposium Liver and gall bladder WARD J. MACNEAL Liver changes in abdominal disease JOHN A. KILLIAN Biochemistry of liver and gall bladder disease CHARLES GORDON HEYD Jaundice LOUIS R. DAVIDSON Postoperative therapy
 B. W. MOFFAT—4 30 Orthopedic surgery

Thursday

FRED H. ALBET—9 Orthopedic surgery
 Staff—9 Dry clinic Diseases of the Breast WARD J. MACNEAL Fibrocystic mastitis HERBERT WILLY MEYER Malignancies of the breast CHARLES GORDON HEYD Surgery of the breast WILLIAM H. MEYER X-ray therapy B. A. GOODMAN Glandular therapy in diseases of the breast EDWARD DENNEN Preoperative and postoperative therapy
 J. W. HINTON—9 Gynecological clinic
 JOSEPH F. MCCARTHY CLARENCE G. BANDLER STANLEY R. WOODRUFF JOSEPH A. HYAMS J. SYDNEY RITTER SAMUEL E. KRAMER and C. TRAVERS STIFFA—9 Demonstration on histopathology of prostate and vesicles exhibition of corrosion specimen mountings of the latter exhibition of methods of intravenous and retrograde urographic diagnosis
 JOHN J. MOORHEAD—2 Traumatic surgery
 GEORGE ANOPOL—4 30 Orthopedic surgery

Friday

J. EASTMAN SHEEHAN—9 Nasal disfigurements congenital or acquired elements all present nasal disfigurements involving loss of elements
 THOMAS H. CHERRY—9 Gynecological operations

Staff—9 Symposium Diseases of the thyroid RALPH R. MOULTEN Classification of goiter JAMES J. FLEMING Iodine in goiter D. PHILIP MACGUTHRIE Preoperative and postoperative therapy CHARLES GORDON HEYD Hyperthyroidism WALDEN E. MUNN The heart in hyperthyroidism RYLAND CHURCH and DR. MEYER Thyroiditis and Keidel's struma
 E. W. PETERSON—9 Pediatric surgery
 WALTER T. DANNEUTH—10 Gynecology
 HENRY H. RITTER—11 Traumatic surgery
 WALTER T. DANNEUTH—2 Gynecological operations
 I. C. RUBIN—2 Surgical clinic lantern slides
 J. F. FIDMANN—30 General surgery
 CHARLES OGILVY—4 30 Orthopedic surgery

BLUTH ISRAEL HOSPITAL

Monday

HARRY T. ISAACS—2 General surgical operations
 HERMAN SCHWARZ—2 Surgery in children

Tuesday

J. J. HERTZ—10 Gastric surgery
 E. G. LANGROCK—11 Surgery in otitis
 I. C. RUBIN—2 Gynecological operations
 MARCUS ROTHENBLUD—2 Medical aspects of surgical cases

Wednesday

I. C. RUBIN—10 Gynecological clinic
 A. HYAM—11 Genitourinary clinic
 A. HYAM—2 Genitourinary surgery
 I. D. DAVIDOFF—2 Neurosurgical operations
 E. D. FRIDMAN—2 Neurosurgical clinic

Thursday

M. ROBINSON—10 Gynecological clinic
 LEO DAVIDOFF—11 Neurosurgical clinic
 DEWITT STIFFA—2 General surgical operations
 A. A. FOSTER—2 Medical aspects of surgical cases

Friday

DEWITT STIFFA—10 Surgical clinic
 MYER ROBINSON—2 Gynecological operations
 ALFRED PLAUT—2 Pathological conference

KNICKERBOCKER HOSPITAL

Monday

LEONARD D. ALLEN—2 Blood transfusion Tindermann method

Tuesday

W. A. FRASER—9 Gynecological clinic
 H. J. SHELL—2 General surgery

Wednesday

PAUL C. MORTON—9 General surgery

JEWISH MATERNITY HOSPITAL

Tuesday

N. RATNOFF and staff—10 Obstetrical clinic
 N. RATNOFF and staff—2 Obstetrical operations

Wednesday

S. J. SCADRON and staff—10 Obstetrical clinic
 S. J. SCADRON and staff—2 Obstetrical operations

Thursday

E. G. LANGROCK and staff—10 Obstetrical clinic
 E. G. LANGROCK and staff—2 Obstetrical operations

BROAD STREET HOSPITAL

Monday
 CHARLES COO MAN— V scular su gery
 GUSTAV J E TIECK—4 S nus operat on
Tuesday
 BENJAMIN T TILTON— o G r l g ry
 WILLIAM A K LOGG— G tro nt tinal gey
 WILLIAM SHARPE—4 N l gical su g y

Wednesday
 A J WALSCHEID—10 Gynecology
 MAURICE MELTZ R—2 Genito urinary su g ry

Thursday
 FRED S DUNN— O al g ry
 FRED H ALB E— Orth p dic u g ry

Friday
 POL N CO YLOS—1 Iho g ry
 M X BARUCH—2 G als g ry
 T F X SULLIVAN—4 G n l su g y

CITY HOSPITAL

Monday
 E t KILBANE— G nito-un ry gery
 J L FULD— O th pedic gery

Tuesday
 L W CROSSMAN—2 Ge l su g ry
 L M COLIE— Gyne ol gy
 G E BINKLEY— Rectal s g ry

Thursday
 J P GRANT— G als gery
 J B CLARK— Genit nary s g y

Friday
 F W PINKHAM— Gynecol gy
 A S MORROW—2 Gen rals g ry
 J R LI A— P th logical onf re e

MEDICAL CENTER

(Bab N l cal Pesbyt nan d Slo
 Ho pitals)

Monday
 J BENTLEY SQUIK— U l gical perat s

Tuesday
 BENJAMIN P WATSON—9 Gyne log l h c

Wednesday
 HUGH AUCHINCLOSS—9 Su gery f the b a t

Thursday
 FORD CE B St JOHN—9 S g ry f the t mach d
 d d um

Friday
 WILLIAM DARRACH—9 Fr ture clinic

DETENTION HOSPITAL

Tuesday
 E VARD C BRENNER r HARRY V S AUDING—9 Gyne
 col gical p ratio

Thursday
 ED VARD C BRENNER o JOSE H FULD—9 Gynec logical
 pe ati ns

BELLEVUE HOSPITAL

Monday
 WILLIAM T DORAN nd associates—2 Gall bladde dis
 eas
 A R STEVENS and staff— Dem nstration f ological
 cases

Tuesday
 RUSSELL H PATTERSON—9 General s rg ry
 ARTHUR M WRIGHT nd staff—9 Ge eral surg ry
 ARTHUR S McQUILLAN a d EUGENE B CK—9 D sea
 I the thyro d
 F C HOLDEN and staff—9 Gynec l g al clin c
 IRA KAPLAN a d staff—9 Treatm t of malignancies by
 radiation
 A R STEVENS and taff—2 U logical p rat

Wednesday
 JOHN E SUTTON—9 Gener l surgery
 ARTHUR M WRIGHT a d staff—9 G e al gery
 F C HOLDEN and staff—9 Gynec l oical clinic
 IRA KAPLAN and staff—9 T e tm t of malgn c es by
 radiati n
 KEN TH M LEVITS I E SIRIS a d LESTER BREIDEN
 BACH—2 Fract e lini
 A R STEVENS a d st ff—2 U logical clinu

Thursday
 St ff s d rg cl di is on—9 Gen al rg ry dry
 ch i
 JOHN H MORRIS d JOHN V BOHRER—9 Ch t g ry
 KEN TH M LEWY—9 V nc e e d n
 GEO GE D STEWART ARTHUR M WRIGHT and staff—
 3 G n ral gery dry clinic

Friday
 CARL G BURDICK—9 Gen ral rg ry
 GEORGE D STEWART ARTHUR M WRIGHT a d staff—
 Ge ral s gery
 JAMES W HINTON—2 G t intestin l clinu
 A R STEVENS nd t ff— U logic lop rat s

ROOSEVELT HOSPITAL

Monday
 JAMES I RU SELL—2 G al rg y
 HENRY W CAVE— C als g ry

Tuesday
 ALFRED STILLMAN—9 G ral u g ry
 HOWARD C TAYLOR—9 Gyn l gy
 CONDUCT CUTLER— Gen l g ry

Wednesday
 KIRBY D IGH—9 G r l su ge y
 THOMAS PE GHTAL—9 Gyn l gy
 GRANT P P NNOYER— G l g y

Thursday
 WILLIAM C WHIT—9 G l su g ry
 HOWARD C TAYLO JR—9 Gynec logy
 HOWARD A PATTERSON—1 G n r l s g ry

Friday
 EDWARD F KILBANE—9 U l gy

CANCER INSTITUTE

Tuesday
 IRA I KAPLAN—2 C clinu

WOMAN'S HOSPITAL

Monday

B H GOFF and R HURD—2 Gynecological operations
GRETE STOHR—2 Pathological demonstration
FREDERICK J MATTHEWS—3 Orthopedic clinic
HARRIETT MCINTOSH—4 X ray diagnosis and therapy in gynecology and obstetrics

Tuesday

HERMAN GRAD and E A BULLARD—9 Gynecology
H G BUGBEE and staff—9 Urological clinic
HARRIETT MCINTOSH—12 X ray diagnosis and therapy in gynecology and obstetrics
GEORGE GRAY WARD L K P FARRAR and W T KENNEDY—2 Gynecological operations
GRETE STOHR—2 Pathological demonstration
W H GLAFKE—2 30 Gastro enterological clinic relating to gynecology
E C LYON and assistants—2 30 Prenatal clinic
H E PARDEE—2 30 Cases of pregnancy complicated by heart disease

Wednesday

GEORGE GRAY WARD and L K P FARRAR—10 Ethical treatment of cases of carcinoma of uterus that have been treated with radium.
E C LYON and assistants—11 Demonstration of obstetrical ward and delivery room technique
HARRIETT MCINTOSH—11 X ray diagnosis and therapy in gynecology and obstetrics

Thursday

R M RAWLS and A H ALDRIDGE—9 Gynecological operations
H G BUGBEE and assistants—9 Urological clinic
HARRIETT MCINTOSH—12 X ray diagnosis and therapy in gynecology and obstetrics
B H GOFF and R HURD—2 Gynecological operations
GRETE STOHR—2 Pathological demonstration
E C LYON and assistants—3 Postnatal clinic
W L CARR H P MISELL and J F LONDON—3 Pediatric clinic

Friday

HERMAN GRAD and E A BULLARD—9 Gynecological operations
E C LYON and assistants—9 30 Prenatal clinic special clinic for abnormal cases and lecture on antepartum care to clinic patients
J N NATHANSON—11 Luric clinic
HARRIETT MCINTOSH—12 X ray diagnosis and therapy
GEORGE GRAY WARD L K P FARRAR and W T KENNEDY—2 Gynecological operations
W H GLAFKE—2 Gastro enterological clinic
GRETE STOHR—2 Pathological demonstration
E C LYON and assistants—3 Demonstration of obstetrical ward and delivery room technique
Note—Daily demonstrations standardized technique by the nursing staff keeping of records by record librarian Inspection of new outpatient clinic on Tuesday Wednesday Thursday and Friday

FRENCH HOSPITAL

Tuesday

P R TURNURE L M ALOPIS M I BLANK H C FALK and staff—9 General surgery

Wednesday

L G COLE and P R TURNURE—9 Surgical and X ray clinic

NEW YORK ORTHOPEDIC HOSPITAL

Monday

ALAN DEE SMITH and staff—2 Out patient clinic

Tuesday

RUSSELL A HIBBS and staff—9 Ward rounds and post operative clinic
RUSSELL A HIBBS BENJAMIN P FARRELL HALFORD HALLOCK and staff—2 Out patient clinic

Wednesday

RUSSELL A HIBBS BENJAMIN P FARRELL and staff—9 Orthopedic operations
ALAN DEE SMITH and staff—2 Out patient clinic

Thursday

RUSSELL A HIBBS and staff—9 End results of spine hip knee ankle and shoulder fusion for tuberculosis
BENJAMIN P FARRELL HALFORD HALLOCK and staff—2 Out patient clinic

Friday

RUSSELL A HIBBS BENJAMIN P FARRELL ALAN DEE SMITH HALFORD HALLOCK and JOSEPH C KISSER—9 Spine fusion for tuberculosis and scoliosis hip and knee fusion for tuberculosis open reduction of congenital dislocation of hip
RUSSELL A HIBBS BENJAMIN P FARRELL ALAN DEE SMITH and staff—2 Out patient clinic

Daily

Drs HALBACH HOWORTH and SAUNDERS Exhibit of anatomical and pathological specimens
A B FERGUSON Photographs and X rays illustrating special X ray technique

RECONSTRUCTION HOSPITAL

Monday

E A DOOLEY—2 Fractures of the forearm
D GOLDBLATT—3 Fractures of the femur
H M BERGMANN—4 Fracture repair clinic

Tuesday

J J MOOREHEAD—9 Traumatic surgery ward rounds
H H RITTER and staff—2 Traumatic surgery operative
H M BERGMANN—2 Traumatic surgery operative
W D LUDLUM JR—2 Traumatic surgery dry clinic

Wednesday

W W LASHER—9 Injuries of the knee
C A PETERSON—10 30 Head and spine injuries

Friday

K G HANSSON and HAROLD W HERRING—9 Physical therapy

STUYVESANT SQUARE HOSPITAL

Tuesday

ALBERT S MORROW—9 Cancer clinic operative

Wednesday

ROBERT H KENNEDY—9 Cancer clinic operative

Thursday

ALBERT S MORROW—9 Follow up clinic on results in cancer patients

Friday

ROBERT H KENNEDY—9 Follow up clinic on results in cancer patients

NEW YORK POLYCLINIC HOSPITAL

Monday

LOUIS J. LADIN—1 30 Gyn. c. logical operations
FRANK C. YEOMANS—1 30 Op. rati. e. pr. ctology
D. A. SINCLAIR—3 Urological operations
J. PRESCOTT GRANT—3 Gen. ral surgical operations
F. C. KELLER—4 30 Dry clinic. Su. gical anatomy

Tuesday

MALCOLM CAMPBELL—9 Op. rative gynecol. gy
HAROLD D. MEERER—11 Ge. e. al su. gical operations
JEROME M. LYNCH—1 30 Op. rati. e. p. octology
ROSS McPHERSON—3 Ob. t. trical clinic
JOHN J. NUTT—4 30 Orthop. dic. op. r. t. ns

Wednesday

GEORGE B. LEE—9 Gyn. e. l. gical p. r. t. ns
A. P. SELLENGES—1 G. n. l. su. gical operations
EDWARD L. KYLOGG—1 30 Gen. t. oenterology
J. J. VALENTINE—3 Urological operations
CHARLTON WALLACE and TOUTICK NICOLA—4 30 O. th. pedics

Thursday

D. W. TOVEY—9 Operat. e. gy. ctology
JOHN J. McGRATH—9 Ge. r. l. surgical operations
HERBERT C. CHASE—1 30 Ge. n. e. l. surgical operations
E. TRIPP M. HAWKS—3 Ob. t. trical
J. E. HAMMETT—4 30 Dry clinic. Su. gery of tongue

Friday

ROBERT L. MCCREADY—9 Op. r. t. e. gyn. ctology
ROBERT E. BRENNAN—1 Gen. e. al su. gical operations
W. V. HEALEY—1 30 F. actur. clinic
H. BERT B. REECE—3 Operat. i. v. ctology

MOUNT SINAI HOSPITAL

Monday

ROBERT T. FRANK and staff—2 Plast. c. op. rati. n. th. gin
RICHARD LEWISOHN—2 Blo. d. studi. sin. jaund. e. cases

Tuesday

A. A. B. M. and staff—9 G. t. o. intestinal surgery
E. WIM BEER and staff—2 G. n. to urinary surgery
HAROLD NEUFOR—2 Demo. strati. n. f. i. b. o. acid. cas. s
W. HARRIS—R. di. o. therapy of su. gical dis. es

Wednesday

PHILIP W. NATHAN and staff—9 O. thop. edics. e. vry
GEO. GE. B. EHR and PAUL KILMPEER—3 30 P. th. l. g. cal demon. strati. on

Thursday

RICHARD LEWISOHN and staff—2 Thy. r. d. u. g. ry
ROBERT T. FRANK—2 Recon. str. u. ti. on f. i. b. gin. dem. n. strati. n. off. i. male. e. ho. m. nes. blood. and ur. ne. tests
LEOPOLD JACHES and staff—2 Roent. g. n. o. l. o. g. cal. spect. s. of. u. rg. cal. d. e. cases.

Friday

PHILIP W. NATHAN—9 D. mon. trat. n. of. o. th. f. ed. c. cases
HAROLD NEUFOR and staff—Chest. s. rg. ry

ST FRANCIS HOSPITAL

F. G. EDGERTON, T. H. RUSSELL, C. J. VERNODA and E. A. CAM BELL—9 d. ily. Ge. r. al. surg. ry. and gynec. l. ogy

FLOWER HOSPITAL

Monday

CLAUDE BURRETT—2 Go. t. er. problems
EARL EATON—Herni. clinic

Tuesday

HORACE AYERS—9 Tum. rs. of the p. l. is
HENRY SAFFORD—9 El. ctive. casa. e
RAGUE CARLETON—2 P. r. t. ic. problems
WAITER HALFMAN—2 Kidney tumors
RAPHAEL LEWY—2 Indust. r. al. surgery

Wednesday

LOUIS KAUFMAN—9 Hydr. ephritis
SAMUEL LUBA H—9 Kidney fun. ti. on. tests
ANSON H. BINGHAM—2 Orth. pedi. u. gery
MILTON WILSON—2 Compo. nd. f. a. t. s

Thursday

WILLIAM F. HONAN—2 Thoracic su. g. ry

Friday

JOSEPH H. FOSB—9 Gen. e. al. surgery
WILLIAM A. FRASER—9 Gen. e. l. s. rg. ry
WILLIAM F. ECKES—9 Gen. t. r. al. u. gery
GEORGE W. LUTTON—2 Tra. m. t. e. n. s. e. c. t. s. f. i. h. d.
E. WELLES KELLOGG—2 Ob. cure. l. s. e. c. ti. o. s. of. w. d.
Note—Demonstrati. n. n. ewer. method. of. n. e. s. t. h. s. by D. n. ald. Bracc. Jam. s. G. i. s. n. d. Geo. g. Van. G. l. w.

ST VINCENT'S HOSPITAL

Tuesday

EDWARD L. KEYES and staff—9 U. l. g. al. d. c.
GEORGE R. STUART—9 Ge. n. e. l. u. g. ry
FRANK N. DEALY—9 Ge. e. al. surg. ry
WILLIAM G. DORAN—9 F. actures

Wednesday

RAYMOND P. SULLIVAN—9 Surg. ical clinic
WILLIAM M. FORD W. KRUGLER, J. McGRATH, J. HENNESSY and A. RAGGI—9 Gynec. l. gical clinic
WILLIAM G. DORAN—Orthop. edics. clinic. congenit. l. d. l. cat. n. of. h. p.

Thursday

GEORGE DAVID STEVART—9 G. n. e. l. g. al. p. r. t.
ARTHUR M. WRIGHT—9 Ge. r. al. su. gical. p. r. t. ns
EDWARD A. KING—9 G. n. r. l. s. gical. op. t. ns
LOUIS F. SANMAN—2 Transfus. on

Friday

WILLIAM M. FORD, W. KRUGLER, J. McGRATH, J. HENNESSY and A. RAGGI—9 Gynecol. cal. h.
CONSTANTINE J. MACGUIRE—9 Surg. ical demon. strati. on. of. cases

NEW YORK HOSPITAL

Tuesday

JAMES MORLEY HITTROT and staff—9 Gen. r. al. s. rg. ry
O. J. LOWSLEY—U. o. l. gy

Wednesday

EUGENE H. POOL and staff—9 G. n. e. r. al. e. gy
O. S. LOWSLEY—2 Clinical demon. strati. n.

Thursday

JAMES MORLEY HITTROT and staff—9 Gen. r. al. su. gery

Friday

EUGENE H. POOL and staff—9 G. n. e. l. s. g. ry

HARLEM HOSPITAL

Monday

Staff—2 Conference on pathology and surgery

Tuesday

H. C. FALK and staff—9 Gynecology

SIDNEY ADLER—2 Rectal diseases

Wednesday

JOHN F. CONNORS, J. WISNER, L. WRIGHT and J. STEIN

BUCK—9 Traumatic surgery

Thursday

H. B. EISBERG and C. CASAS—9 General surgical clinic

A. M. SALA and B. BERG—2 Surgical pathology

Friday

H. C. FALK—9 Diagnostic gynecology

F. KA. SEBOHM—2 Obstetrical clinic.

MISERICORDIA HOSPITAL

Monday

F. W. SOVAK—2 Gynecology

Tuesday

ANTHONY H. HARRIGAN—9 General surgery

Wednesday

ROBERT E. BRENNAN—9 General surgery

JACOB HECKMAN—2 General surgery

Thursday

EDWARD F. KILBANE—9 Genito-urinary surgery

ALEXANDER H. SCHMITT—2 Obstetrics.

Friday

FRANCIS E. BUTLER—9 Orthopedics

GASTON A. CARLUCCI—2 General surgery

LEBANON HOSPITAL

Tuesday

HARRY ARANOW, A. J. RONGY and EDWARD SCHNAPER—9 Gynecology

Wednesday

MILTON R. BOOKMAN, PHILIP M. GRAUSMAN, L. MILLER

KAHN and HENRY ROTH—9 General surgery

Thursday

HARRY ARANOW, A. J. RONGY and EDWARD SCHNAPER—9

Gynecology

Friday

MILTON R. BOOKMAN, PHILIP M. GRAUSMAN, L. MILLER

KAHN and HENRY ROTH—9 General surgery

MONTEFIORE HOSPITAL

Monday

JULIUS GOTTESMAN, MAURICE LENZ and J. M. ZIEGLER—2 Cancer clinic.

Tuesday

P. W. NATHAN—9 30 Orthopedic surgery

Wednesday

HAROLD NETHOF—2 30 Thoracic surgery

Thursday

IRA COHEN—2 Neurosurgical operations

HOSPITAL FOR JOINT DISEASES

Tuesday

P. M. GRAUSMAN—9 General surgery

HARRY GOLDMAN—10 Proctological surgery

H. L. JAFFE—11 30 Pathology

A. J. BELLER—2 General surgery

MILTON BODENHEIMER—2 General surgery

Wednesday

H. L. FRAUENTHAL, LEO MAYER and M. M. POMERANZ—9 Orthopedic clinic operations and demonstration of cases roentgenological demonstration of bone lesions

Thursday

PAUL W. ASCHNER—9 Urological surgery

ARTHUR STEIN—10 Gynecological surgery

M. M. POMERANZ—11 Pyelography

Friday

H. FINKELSTEIN—9 Orthopedic operations.

SAMUEL KLEINBERG—10 30 Demonstration of orthopedic patients

LINCOLN HOSPITAL

Tuesday

KIRBY DWIGHT and B. SHERWIN—9 General surgical operations

E. T. HULL—9 Gynecological operations

Wednesday

E. D. TRUESDELL and C. S. ROGERS—9 General surgical operations

P. H. WILLIAMS—9 Gynecological operations

G. GOTTLIEB—2 Roentgenology

Thursday

G. AUFRICHT and J. FRIEDMAN—9 Plastic surgery

Friday

E. J. DAVEN—9 Gynecological operations

KIRBY DWIGHT and staff—9 General surgery

METROPOLITAN HOSPITAL

Monday

J. H. FOBES and staff—9 General surgery

Tuesday

SPRAGUE CARLETON and staff—10 Genito-urinary surgery

W. F. HOVAN and staff—2 Thoracic surgery

Wednesday

H. B. SAFFORD and staff—10 Gynecology

R. F. WARD and staff—2 General surgery

Thursday

W. A. FRASER and staff—2 General surgery

Friday

A. H. BINGHAM and staff—10 Orthopedic surgery

L. C. SALISBURY and staff—2 General surgery

ST. MARY'S HOSPITAL

Tuesday

C. E. FARR—9 Undescended testis in children

Thursday

EDWARD D. TRUEDELL—9 Hare lip and cleft palate

Friday

LUCIUS A. WING—9 Congenital deformities.

ST LUKE'S HOSPITAL

T e s d y

WATSON M R IN—9 Ge n l surgery
J IN DOUGLAS—9 Ge n l surgery

W e d d a

H H M L E—9 Ge n l surgery
I R A S MATHEWS—9 Ge n l surgery

T h u r s d a y

EDWARD J DONOVAN—9 Ge n l surgery
WILLIAM F MACFEE and EDWARD D TRUESDELL—9 Ge n l surgery

F r i d a y

MORRIS K SMITH—9 Ge n l surgery
HENRY C BURGESS—9 Ge n l surgery
MATTHEW CL VELA D—9 O t h o p e d c u r y

FORDHAM HOSPITAL

M o n d a y

A G FORDMAN—2 Ge n l surgery

T u e s d a y

I MARTON—2 Ge n l surgery

W e d n e s d a y

I R CUNIFFE—9 Ge n l surgery

T h u r s d a y

S W BOORSTIN—9 O t h o p e d c u r y
ALAN WYATT NICOLL—9 Ge n l surgery

F r i d a y

J H T T A L—9 O b s t r i c t i o n
I L T W LSH—2 Ge n l surgery

MORRISANIA HOSPITAL

T u e s d a y

J L A A R—9 Ge n l surgery
J S J A TINE—2 30 U o l g e n l surgery

W e d n e s d a y

F A S I S—9 F e c t
J L A M T P—3 Ge n l surgery

F r i d a y

F R C L MIF—9 T h u r s d a y
C M L A —2 30 Ge n l surgery

F r i d a y

I A S P I S—9 O p e r a t i o n l u g y

MIDTOWN HOSPITAL

W e d n e s d a y

J S E RITT R—9 U l g e n l surgery

T h u r s d a y

LOUIS MARON—9 Ge n l surgery

F r i d a y

MARTIN J SYNOTT—4 I o c t o l g e n l surgery

LYING IN HOSPITAL

J M E A HARRAR C F J E L I N G H U S J A W I C M
R O E N O H N W H H A W I N S K B S T E L E F R
S M I T H J A O R E N B S A C K E T T J T S H E
M A W C G O D R D R L C A I G —9 d a i l y O b
t r i n l l i d i b t r y l m s t t s

GOUVERNEUR HOSPITAL

M o n d a y

THOMAS H RUSSELL—9 Ge n l surgery

T u e s d a y

WILLIAM V HEALEY—9 F a t u c u r y
EDWARD L KELLOGG—2 Ge n l surgery

W e d n e s d a y

WILLIAM A KELLOGG—9 Ge n l surgery
WILLIAM H W KNIFE—9 O b t r i n
PHILIP M GRAUSMAN—2 Ge n l surgery

T h u r s d a y

JOSEPH GIRDANSKY—9 Ge n l surgery
ALBERT E SELLENINGS—2 Ge n l surgery

LENOX HILL HOSPITAL

T u e s d a y

FRANK R OASTLER and staff—9 Gynecological
FRANK R OASTLER and staff—9 Gynecological

W e d n e s d a y

DEWITT STETTIN and staff—9 Ge n l surgery
CARL FOGGERS and staff—9 Ge n l surgery

T h u r s d a y

HERMAN FISCHER and staff—9 Ge n l surgery
OTTO H PICKHAUS and staff—2 Ge n l surgery

F r i d a y

PERCY H W L I A M S and staff—9 Gynecological
PERCY H W L I A M S and staff—9 Gynecological

JERSEY CITY HOSPITAL

(Jersey City N J)

T u e s d a y

CHARLES B KELLEY—9 Gynecological
S B S R GUE—9 Gynecological

T h u r s d a y

S A COSGROVE—9 O b t r i n
W G DOUGLAS—2 F a c t u c u r y

F r i d a y

W G DORAN—9 O t h o p e d c u r y
t n f h p m t n p c t d m t r a t

BRONX HOSPITAL

T u e s d a y

A O WIRENSA—9 Ge n l surgery

W e d n e s d a y

LEO BUFFGGER—9 Ge n l surgery
S NE COIN—9 Ge n l surgery

F r i d a y

SIDNEY COIN—9 Ge n l surgery
A O WIRENSA—9 Ge n l surgery

CORRECTION HOSPITAL

T u e s d a y

EDWARD C BRENNER—9 Ge n l surgery

W e d n e s d a y

GEZ G E NBERG—9 Gynecological surgery

T h u r s d a y

L A C BRENNER and M O MAGID—9 Gynecological
p e t n

SPECIAL CLINICS FOR BROOKLYN LONG ISLAND DAY—WEDNESDAY

LONG ISLAND COLLEGE HOSPITAL

Department of Urology

- J S READ Resection of infected renal calyx with stone
 A HARRIS Nupercain anesthesia in urology
 I L SINGER End results in ureterostomostomy
 G R HORTON The prostate and vesicles as foci in arthritis
 W B TATUM Stricture of the female urethra
 P C FLERI Idiopathic scrotal gangrene
 E K MORGAN Five years experience with vas resection
 F C FARROW Resection of urethral diverticulum

Department of Obstetrics and Gynecology

- A C BECK End results in eclampsia
 W A JEWETT Complications of fibroids
 GORDON GIBSON Prolapse of the uterus
 H B MATTHEWS Ectopic gestation in women over thirty five years of age
 S A WOLFE Sarcoma of the uterus
 G W PHELAN Seminoma of the ovary
 A HARRIS Complications of ovarian tumors
 T S WELTON Congenital atresia of the vulva
 M GLASS Intrauterine pregnancy
 A S MACGREGOR Embryonal carcinoma of the ovary in a fifteen year old girl
 V P MAZZOLA Postabortal sepsis
 S KAMINSTER Aschheim Zondek and similar tests
 M V ARMSTRONG Management of occipitoposteriors

Department of Surgery

- E GOETSCH Preparation of patients with hyperthyroidism for operation factors of safety with especial reference to the use of iodine
 R F BARBER Test for circulatory efficiency in extremities
 S I BARTLEY Complications and dislocations of the shoulder joint with end results
 A GOETSCH Results of combined treatment with X ray and the administration of Lugol's solution in early hyperplasias of the thyroid
 R F HARLOW The surgical treatment of bilateral empyema
 B M CASSEL Thyroductal anomalies pathology and surgical treatment
 E J BROWDER Diagnosis and treatment of brain abscess
 E P DUNN Suppurative mediastinitis presentation of a case
 D A MULVHILL Malignancy of the thyroid gland report on a study of 27 cases
 I J GRACE A study in tissue culture 45 malignant and non malignant tumors

NORWEGIAN LUTHERAN HOSPITAL

- I LERRIS E SKELTON D LIVINGSTONE L STORK P PLATOU B HARRIS J H B DOWD G HUNTER and J J MASTERSON—9 General surgical gynecological and orthopedic operations and rounds X ray exhibit
 F FERRIS— Treatment of fractures by open and closed reduction
 D LIVINGSTONE—2 3 Hypertrophic pyloric stenosis in newborn
 E SKELTON—3 Perforated peptic ulcers
 B HARRIS—3 30 Management of cervical stenosis in labor
 P PLATOU—4 Spinal anesthesia

KINGSTON AVENUE HOSPITAL

- Staff Dry clinics and exhibition of cases
 RALPH I HARLOW Treatment of empyema

ST PETER'S HOSPITAL

- MATTHEW G GOLDEN Bronchoscopic diagnosis of diseases of the respiratory tract lantern slides
 T A MCGOLDRICK Clinical considerations in above cases
 CORNELIUS SCHMID Operability in thyroid disease
 HARRY MCTAGUE Arterial occlusion in cardiac arrhythmia with gangrene of an extremity carcinoma of the thymus gland
 HAROLD DENMAN Syphilis of the lung
 NUNZIO RINI Experiences in spinal anesthesia
 SAMUEL SCUDERI Pancreatic cyst
 LOUIS BERGER Clinical management of acute intestinal obstruction
 JOSEPH TOOO Treatment of sterility in the female with end results
 WILFRED EGAN Uterine fibroids—salient points in diagnosis clinical course and ultimate results
 JOSEPH MCGOLDRICK Hysterectomy
 WILLIAM EVNIS An improved method of operative treatment in inguinal hernia
 FREDERIC PAPFARD Experience in management of abdominal surgical cases
 HENRY MORTON Abdominopelvic fascia in relation to suprapubic cystotomy
 THOMAS M BRENNAN A study of case histories in obstructive jaundice with comment on diagnosis clinical course and management
 GORDON GIBSON Conservative treatment of pelvic inflammatory disease
 JOHN E JENNINGS Thromboangiitis obliterans
 JAMES SHAY Postoperative pulmonary complications
 LOUIS BREGGIO Report on a series of cases of acute empyema with conclusions
 HENRY FEINBLATT Types of hyperthyroidism
 LORNE M RYAN Gall bladder disease
 FRANK RYAN Demonstration of urological cases
 HERBERT FETT Demonstration of orthopedic cases
 RICHARD A RENDICH Gastrointestinal diagnosis

CARSON C PECK MEMORIAL HOSPITAL

- JOHN F RANKIN—9 General surgical operations
 CHARLES S COCHRANE and STANLEY D BANKS—9 General surgical operations
 MERRILL N FOOTE—9 General surgical operations
 WILLIAM W HALL—9 Exhibition of specimens and newer laboratory tests for pregnancy
 CHARLES EASTMOND—10 Radiographic study of gastrointestinal obstruction
 H C ALLEN R L WOOD and O A GORDON JR—Obstetrical conference on spinal anesthesia in obstetrics exhibition of cases
 HERBERT T WIKLE—2 General surgical operations
 THEODORE I VOSSLER and CARLETON CAMPBELL—A study of peritonitis

BUSHWICK HOSPITAL

- C H REICHERS and staff P E SMITH G KASPER and staff and H W BENOIT—9 and 1 General surgical operations
 W E LIPFOLD and staff and H W DANGLER—9 Gynecological operations
 NATHAN ADLER—10 Emergency obstetrics
 R C WEITHAS—11 Genito-urinary operations
 B F MACGIO—11 Treatment of fractures
 W E LIPFOLD and S SCHUSSEIM— Spinal anesthesia follow up clinic
 M WEISSBERG and EMIL KOCH—2 Pathological conference

ST MARY'S HOSPITAL

- Staff—9 Operative clinics in general surgery gynecology urology proctology and orthopedics
 Staff—9 and 10 Clinics
 R B ANDERSON Urological cases
 W V PASQUAL Gall bladder cases abdominal wall in section
 W MONTGOMERY JR Importance of blood chemistry in disease
 W E McCOLLUM Diabetes in surgery
 A W MERRITT MAKING Hirschsprung disease chronic ulcerative colitis
 EDWARD P. DUNN Thyroid disease
 D E WELCH Tendon suture
 CHARLES H. LOUGHRAN and D C A. NOLAN Improved methods in blood matching
 J R. O'NEILL MURPHY Injection treatment of varicose veins
 P J DILLON Vincent's angina gangrenous angina gangrenous infection
 E J CROVY Unusual complications in acute appendicitis
 C A KEES Ovarian cyst complicated pregnancy
 M MURPHY End results in breast cancer
 CHARLES LOUGHRAN Bandaging cancer amputation
 J J CORINS Endarteritis obliterans
 F W CURRIN Disease of the bone
 J P MURPHY Chronic synovitis of knee
 J P MURPHY and E J GRACE Result of osteogenic sarcoma and amputation
 F J GRAE Graded cancer of breast and prognosis
 Culture research on surgically excised neoplasms
 R F McNALLY Bacteriophage washings from ulcerative infections
 WILLIAM MONTGOMERY JR Trichomonas vaginitis infection in relation to gynecology
 T M BRENNAN Autopsy cases
 Staff Practice line

ST JOHN'S HOSPITAL

(Long Island City)

- WILLIAM J. L. VELLE and S. KLEIN Distal femoral fracture treatment of fracture of femur by open reduction
 J. J. McILVAINE and S. KLEIN Abdominal cysts and fistulae
 J. P. L. McHUGH, M. WEINSTEIN and S. KLEIN Hysterectomy for fibroma of the uterus resection of thrombophlebitis biliousness
 C. ROE C. BROWN—11 Postoperative condensation of prostate
 D. WYNN E. McMAHON, I. L. STEIN and S. KLEIN Cholecystectomy for gall bladder disease thoracotomy by closed method for pyema
 HENRY P. MENCKEN—1 Unusual obstetrical cases of high forceps

CONEY ISLAND HOSPITAL

- J. EARL MILES Tubal ligation on with abdomen open
 GEORGE W. B. SHLETTEN Cystitis
 D. A. McATEER Tumor of shock
 PHILIP GOLDSTEIN Radical prostatectomy
 PAUL WESEBERG Difficult labor
 ARTHUR C. GRAVES Cesarean section in threatened tetanus
 WILLIAM B. TATUM Menstruation in ruptured kidney
 RAY M. BOYLE Spontaneous perineal proctectomy
 A. J. MENDELSON Vaginal demonstration of bone tumor

CUMBERLAND HOSPITAL

- H. WIKLE—9 Peritoneal sympathectomy motor picture demonstration
 JOHN GAINNEY and staff—9 General surgical operations
 J. F. JENNINGS and MERRILL N. FOOTE—9 General surgical clinic
 FUAD I. SHATARA—30 Demonstration of the Russell's bandage apparatus for treatment of fractures of femur with exhibition of patients recovery of the injection treatment of aneurysms as compared with operative treatment exhibition of patients general operations
 MERRILL N. FOOTE and staff—10 General surgical operations
 JOHN F. JENNINGS—11 General surgical operations
 MERRILL N. FOOTE and M. J. FEIN—11 Hip stoppage of gaiter
 H. WIKLE and staff—11 General surgical operations
 JOHN GAINNEY—12 Surgery for the chronic pyelitis analysis and end results
 M. J. FEIN—Gross pathology and related theories from specimens from slides
 JOHN E. JENNINGS, MERRILL N. FOOTE, CHESTER DAVIDSON and JOHN GAINNEY—2 Demonstration of interesting cases
 ROBERT J. MCKEON—2 Transplantation of the uterus with exhibition of patients
 FREDERICK ELLIOT—3 Radiography as related to general surgery diagnosis discussed and illustrated by moving picture head neck chest abdomen and fracture especially reference to intestinal fracture
 CHESTER DAVIDSON—4 Surgical treatment of ulcerative cases

JEWISH HOSPITAL

- WILLIAM LINDER, WILLIAM WOLFSON, S. M. LINDER and staff Cancer of the colon operation
 JOHN LINDER, A. H. LASON, LOUIS BERGER and staff Gastrectomy for ulcer and cancer of stomach
 HENRY W. LOURIA Thyroid surgery
 A. R. VICTOR L. thymoplastic pyelonephritis operation
 R. E. WOLKOFF End results in bone graft and elbow fracture
 BENJAMIN KOVEN and MORRIS KOVEN Functional treatment of fractures
 BENJAMIN KRAMER Diet management of intestinal indigestion calcification in vitro in living tissue demonstration
 ADOLPH BOYNER Treatment of carcinoma of cervix
 M. G. WASCHER Radiological demonstration of metastatic disease of bone malignancy of bone pre and post operation multiple general tumor pneumoperitoneum gastrointestinal studies
 MAX LEDERER Demonstration and exhibition from demonstration of pathology
 I. SANDS Vascular brain abscess
 M. ROSENZWEIG Aschheim Zondek test for pregnancy
 M. CARNES and H. RAUCHOFF Pediatric surgical and obstetrical pathology
 W. Z. FRIEDMAN Radiological apparatus
 A. S. WIENER Tests of newborn for preterm
 M. LEDERER Pathological conference
 S. H. POLAYES Blood transfusion

HOUSE OF ST. GILES

- C. A. LESLIE, D. WAPIER and JOSEPH B. LEFFEL—2 Exhibition of orthopedic cases

METHODIST EPISCOPAL HOSPITAL

- Staff—9 a m and 2 p m Operative and dry clinics
 C H GOODRICH and R F SEMEN-TICKER End results following goiter operations
 H T LANGWORTHY Tumors of the kidney
 H K BELL Acute osteomyelitis
 D E MCKENNA Dislocation of cervical vertebra exhibition of case
 E J BROWDER Management of peripheral nerve injuries with end results and exhibition of ca es
 CLAUDE C KELLY (Hartford) Plastic surgery lantern slide demonstration
 FRED RANKIN (Mayo Clinic) Dry clinic
 S G CLARA Ectopic pregnancy rupturing into the sigmoid
 J H BLISS Role of calcium metabolism in hyperthyroidism
 J A TINK Injection treatment of varicose veins

Symposium on Gall Bladder Disease

- O P SCHOENEMANN Anatomy of biliary tract
 F B SMITH Pathology of gall bladder and liver
 H GRAHAM Early operation for acute cholecystitis
 RUSSELL FOWLER Unusual gall bladder cases
 F B CROSS Pre and postoperative use of glucose exhibition of cases
 P A REVAUD Cholecystectomy without drainage

Symposium on Obstetrics

- O I HUMPHSTONE Cesarean section in the treatment of bleeding during pregnancy
 R M BEACH Medial versus lateral episiotomy moving picture demonstration
 H B MATTHEWS Management of pregnancy in the presence of pulmonary tuberculosis
 H W MAYES Vaginal versus rectal examinations in relation to obstetrical morbidity

LUTHERAN HOSPITAL

- A von P FARDELMANN—10 Hypertrophic pyloric stenosis in infants—history diagnosis treatment and results presentation of cases
 WALTER LYNN—10 Operative gall bladder mortality
 DELVINO MASCOLO—11 Subphrenic abscess cases
 PAUL RAJA—11 Fibromata of intestines pathological and lantern slide demonstration
 VINCENT BARBER—11 30 Lipoma of intestine causing intussusception
 EMIL F KOCH—2 Pathological demonstration
 H C EICHACKER—2 Discussion of eclampsia
 HEI RICH WEHRBEIN and ALBERT L VOLTZ—2 30 Interesting types of urinary tract pathology
 V GIANTIERI—2 30 Leucorrhea
 ALBERT L VOLTZ—2 30 X ray demonstration Types of mastoids roentgenologically considered chest differential diagnosis X ray diagnosis X ray diagnosis of bleeding ulcer by use of hydrogen peroxide (Dr L Dinlen method Berlin) unusual cases of general interest
 H C EICHACKER—2 45 Cesarean section review of cases
 CAMERON DUNCAN—3 Uterine bleeding lantern slide demonstration

GREENPOINT AND ST CATHERINE'S HOSPITALS

- FRANK D JENNINGS and FRANK TARNNEY Demonstration of pelvic hammock a new device for rhythmic traction in the treatment of fractures
 JOHN M SCANNELL Demonstration of method and technique of blood transfusion
 FRANK D JENNINGS Consideration of inguinal hernia

WICKOFF HEIGHTS HOSPITAL

- JOHN C KRAUS JOHN HORN RUSSELL S FOWLER and CHARLES FYLUG—9 General surgical operations
 J ARTHUR BUCHANAN—9 45 A surgical purpura
 LEO LEFOWITZ—10 Syphilis of the liver
 ALBERT COOK—10 15 Diverticulitis
 GEORGE FORBES—10 30 X ray demonstration on pneumothorax
 DAVID GINGOLD—10 45 Pyloric stenosis in infants
 CARL FISCHER—11 Ruptured uterus at term fetus in abdominal cavity caesarian section
 RUDOLPH HERRMAN—11 15 Caesarian section moving picture demonstration
 WILLIAM B ROSECRANS—11 30 Fractures of the skull paralysis operation and recovery
 CHARLES FYLUG—11 45 The more common dislocations
 WILLIAM BOZENHARDT—12 Papillo adenoma of kidney metastasis in bladder one year later
 E C BERNAUER—12 15 Impetigo in obstetrical work lantern slide demonstration
 L DREXLER—1 30 Renal carbuncle moving pictures
 J G KRAUS—1 45 Foreign body in knee joint magnet
 WILLIAM COOK KARL MUELLER JR RUDOLPH HERRMAN and ARTHUR HOLMA General surgical operations
 JOHN HORN—2 15 Subtotal resection of stomach
 THURSTON DEXTER—2 30 Pathology of gall bladder disease

- CHRISTIAN JAYNE—2 45 Evaluation of the various liver function tests

- ARTHUR HOLZMAN—3 Anomalies of cystic and hepatic arteries

- RUSSELL S FOWLER—3 15 Intractable abdominal sinus
 WILLIAM LAINO—3 30 Diabetes mellitus suppurative osteomyelitis of first metatarsal surgical cure
 ROSARIO MULÉ—3 45 Genito urinary cases

ST JOHN'S HOSPITAL

- GLEN R MACLACHLAN—9 Report on breech deliveries
 CHARLES W MUELLER—10 Management of placenta previa
 CAMERON DUNCAN—10 30 Cervical dystocia in elderly primipara
 ALFRED W WHITE—11 Resumé of two years obstetrical work
 ONSLOW A GORDON—11 30 Discussion of ward cases
 GEORGE R MARSH—12 Clinical study of inguinal hernia with end results
 STANLEY B THOMAS—2 Cancer of the rectosigmoid choice of operation
 ROBERT B ANDERSON—2 30 Is nephrectomy indicated in the unilateral closed tuberculous kidney?
 JOHN E JENNINGS—3 Surgery of the terminal ileum
 AUGUSTUS HARRIS—3 30 A general consideration of fibrous vesical neck obstruction
 G FRANK SANNUS—4 Consideration of full thickness (tube) graft and fascial transplant
 WARREN L DUFFIELD—4 30 Clinical review of cases of pericolic membranes

NORTH COUNTRY COMMUNITY HOSPITAL

(Glen Cove)

- A M BELL W I TITUS G L FAIR and M J DUNNE—9 Obstetrical clinic
 R DERRY J W BULMER M W JACKSON G D DUREY J L NEUBERT and A F ROWSON—9 30 General surgical clinic
 E C JESSE N C STEVENS R E LEASE E C BRAY NARD and F C EDMONDS—10 30 Medical clinic
 L D LARIMORE—11 30 Laboratory demonstration

BROOKLYN HOSPITAL

W A SHERWOOD E K TANNER W H FIELD and J B
GIVEN JR—9 General surgical operations and le-
mon treatment of ca
V L ZIMMERMAN L Bitton and W S SMITH—9
Gynecological and b tetric al op ratio and d m n
str t n of ca es
N P RATHBUN and W F McKENNA—9 Cyt copc
clmic
Staff—1 Demon tr t n fu l g al l ray
W A SHERWOOD and JAMES DENTON— S p c l
p th l g cal onfe c c
D L McKENNA—23 Orthop d op rat n s a d
lem n tr t n of ca es
J E JENNINGS— General g y drycl thd m n
st t n of ca es
N I RATHBUN and W F McKENNA—2 Ur l g cal
pe ton

FLUSHING HOSPITAL

(Flushing)

J S THOMAS—930 General urg al operations
A S LOVELLY and W K ROGERS—93 General g
cal clin c
C J J LAWRENCE and J L MORRISSEY—93 Cyn
c log alop ation

NASSAU HOSPITAL

(Min la)

Staff—9 General su r c lope r t n

QUEENSBORO SURGICAL SOCIETY

Sp cal m t gat 33 pm in the b l d n of the Q
County Medical S cety 2 Q en B ule a d
EDWARD L KEYS Th p n ples fpr st t c gery
MARTIN B TINKER Ithaca N Y Imp tant po t n
the t chn qu of gote op t ns

CLINICS IN BROOKLYN AND LONG ISLAND HOSPITALS

WYCKOFF HEIGHTS HOSPITAL

T d y

J IN L B UFF—9 General ls t r y
JOI K KRAUSS—9 General ls t r y
PU ELLS FOWLER— General lsu gery
ARTI R HOLLMAN—9 General lsu gery
W A I B ROSEMAN—9 General lsu gery
RUDOLPH H KIMAN— Obst t c
C R O FISHER—3 Obstetrics
RUBA O MULL—4 Urolog c l pe at on

Th d y

JOHN L B ER—9 General lsu gery
JOHN C KRAUSS—9 General lsu gery
RUBA O MULL—4 Urolog c l pe at on
A THUR H LIZMAN—1 General lsu gery
WILLIAM H ROSECRANS—1 General lsu gery
R DOL I HERMAN—2 Obst tics
CA LO F SHER—3 Obst tics
RUBA O MULL—4 Urolog c l pe at on

F d y

ALBIE G LOOK—9 General lsu gery
W L F BOZENHAUT—9 General lsu gery
WILLIAM COOK—9 General lsu gery
J R HIRSH—11 General lsu gery
C L F LUG—1 General lsu gery
L DREXLER—Urolog c l pe at on
E F ORES—2 X y lu
HENRY DIRM—3 Obst tics

BROOKLYN HOSPITAL

T d y

W A SHERWOOD—9 General lsu g l op atio
V L ZIMMERMAN and staff—9 Obstet al and gyn co
l g cal in and onfe n

Th sd y

W A SHERWOOD—9 General lsu g cal pe at on
JOHN E JAMES—9 General lsu g cal p s
N P RATHBUN—9 Cyst s p chn c
D E McKENNA—1030 Orthop d p rat s

F d y

W A SHERWOOD—9 General lsu g l op atio
N P RATHBUN—9 Urolog cal op at
V L ZIMMERMAN—9 Gynec l g cal pe at s
J M S DENTON—1 Clin c l s g al pathol g cal on
fe tnc

KINGS COUNTY HOSPITAL

T d y

L H FISKE J TENOPYR and J RAPHAEL—9 General
u gery
R M ROSE W E LINDS and H W BEATT—9 General
u gery
H F FRASER and C S COCHRANE—2 General u gery p
t n
R A RENDICH—2 X ray d mon t t n

Th d y

L H FISKE J TENOPYR and J RAPHAEL—9 General
u gery
R M ROSE W E LINDS and H W BEATT—9 General
u gery
C D NABER R C WILLIAMS and J B LEWIS—2
Orthop d c s

F d y

S J McN MARA and R H GARLICK—9 Gynec l g y
H M VIRE—9 Obst tics
C DUNN and C F RYND—9 Gynec l g y and b
t tics
H L FRASER and C S COCHRANE—2 General u gery
u gery
C F McCRORY—Phy therapy clin c

NORWEGIAN LUTHERAN DEACONESSES
HOSPITAL

T d y

E FERRI—9 General u gery
C HUNTER—9 Orthop d c s
C LANG—1 Genito-u in ry u g ry
D LIVINGSTONE—11 General u gery
E FERRI J H B DOWD and C LANGE—Dry chn

Th d y

W B DUKESHIRE and P PLATON—9 General surgery
ROBERT W TATE—General surgery
J H B DOWD—11 Obstetric
W B DUKESHIRE P PLATON and B HARRIS—Dry
chn

F d y

H A FISHER—9 General u gery
R P SAN FILIPPO—9 General u gery
WILLIAM C FLICKINGER—9 General u gery
WILLIAM G FLICKINGER R P SAN FILIPPO ROBERT W
TATE and H A MEHLBAUM—2 Dry chn c

LONG ISLAND COLLEGE HOSPITAL

Tuesday

WILLIAM A JEWETT GORDON GIBSON H B MATTHEWS
and A C BECK—9 Obstetrics and gynecology
J D RUSHMORE—9 Orthopedics

Thursday

W A JEWETT GORDON GIBSON H B MATTHEWS and
A C BECK—9 Obstetrics and gynecology
J D RUSHMORE—9 Orthopedics
J S READ F L SINGER and A L HARRIS—2 Urology

Friday

EMIL GOETSCH R T BARBER S P BARTLEY ARTHUR
GOETSCH and R F HARLOW—9 General surgery
J D RUSHMORE—9 Orthopedics
J S READ F L SINGER and A L HARRIS—2 Urology

ST JOHN S HOSPITAL

Tuesday

WARREN L DUFFIELD—9 General surgery
STANLEY B THOMAS—9 General surgery
ROBERT B ANDERSON—10 Genito urinary operation
ONSLAW A GORDON JR—2 Obstetrics

Thursday

ROBERT B ANDERSON—9 Genito urinary operations
STANLEY B THOMAS—9 General surgery
CAMERON DUNCAN—2 Obstetrics

Friday

G FRANK SAMBIS—9 General surgery
WARREN L DUFFIELD—9 General surgery
HAROLD A BELL—9 General surgery

LUMBERLAND HOSPITAL

Tuesday

JOHN GAINY and staff—10 Cancer clinic operations and
demonstration of cases

Thursday

MERRILL N FOOTE and staff—9 Goiter clinic operations
and demonstration of cases
ROBERT L KINLOCK and staff—2 Urological clinic opera-
tions and demonstration of cases

Friday

JOHN L JENNINGS—9 General surgery dry clinic
MERRILL N FOOTE and F T SHATARA—2 Varicose vein
clinic

LUTHERAN HOSPITAL

Tuesday

A V P FARDELMANN—9 General surgery
N P RATHBUN—9 Urological clinic

Thursday

VINCENT BARBER—9 General surgery
CAMERON DUNCAN—9 Gynecology

Friday

EDWARD MAY—9 Obstetrics

HOLY FAMILY HOSPITAL

Tuesday

JAMES M DOWNEY—9 General surgical operations

Thursday

JOSEPH S BALDWIN—9 General surgical operations

ST MARY S HOSPITAL

Tuesday

WILLIAM V PASCUAL—9 General surgery
P J DULLIGAN—9 General surgery
E A KEYS—9 Gynecology
R B ANDERSON—9 Urology
Staff—2 Fracture clinic

Thursday

WILLIAM V PASCUAL—9 General surgery
P J DULLIGAN—9 General surgery
E A KEYS—9 Gynecology
R B ANDERSON—9 Urology
Staff—2 General surgery dry clinic transfusion

Friday

J P MURPHY—9 General surgery
T M BRENNAN—9 General surgery
J P CRYAN—9 Gynecology
T A SHIELDS—9 Proctology

ST PETER S HOSPITAL

Tuesday

GORDON GIBSON—9 Gynecology
J TODD—9 Gynecology
H FETT—9 Orthopedics
H MORTON—2 Genito urinary operations

Thursday

J E JENNINGS—9 General surgery
T M BRENNAN—9 General surgery
F I AFFARD—9 General surgery
W LYNIS—9 Traumatic surgery
H MORTON—2 Genito urinary operations

Friday

GORDON GIBSON—9 Gynecology
J TODD—9 Gynecology
H FETT—9 Orthopedics
H MORTON—2 Genito urinary operations

MARY IMMACULATE HOSPITAL

(Jamaica)

Tuesday

FRANK M DEALL—9 General surgery

Thursday

LOUIS LIGHT—9 General surgery
ROBERT B ANDERSON—9 Genito urinary surgery
EMIL F KOCH—2 Surgical pathology

Friday

JOHN M SCANNELL—9 General surgery and spinal anes-
thesia demonstrations
ALLEN ROBINSON—2 Radium therapy

NORTH COUNTRY COMMUNITY HOSPITAL

(Glen Cove)

Tuesday

A M BELL—9 Operative obstetrics
E C JESSUP—9 Medical demonstrations

Thursday

M C HILL—9 Pediatrics
G F HOCH—9 Urological operations

Friday

L D LARIMORE—9 Laboratory demonstration

METHODIST EPISCOPAL HOSPITAL

T day

R S FOWLER T B SPENCE C H GOO RICH and H K
BELL—9 Gynecology
O P HUMPHSTONE and H B MATTHEWS—9 Obstetrics

Thrsday

H T L NGWORTHY—9 Urology
R S FOWLER T B SPENCE C H GOO RICH R F
SEIDEN TICKER H K BELL—9 Gynecology
O P HUMPHSTONE and H B MATTHEWS—9 Obstetrics

Friday

H F GRAHAM A H BOGART and P A RENAUD—9
General surgery
R M BACH and H W MAYES—9 Obstetrics

CALEDONIAN HOSPITAL

Friday

CALVIN BARBER—9 General urology
JOSEPH TENOPYR—9 Gynecology

Thrsday

CALVIN BARBER—9 Gynecology
JOSEPH TENOPYR—9 General surgery

Friday

WILLIAM A JEWETT—9 Obstetrics
JOSEPH TENOPYR—9 General surgery
CHARLES S COCHRAN—2 Gynecology

NASSAU HOSPITAL

(M la)

T day

W M POST and A S W RINNER—9 General urology
W L SNEYD—9 Orthopedic operations

Thrsday

H C MARTIN—9 Obstetrics and gynecology
G F CLEGG—9 Gynecology
J W MCCHESENE—9 Urology

Friday

G F CLEGG and W S S HORTON—9 General urology

GREENPOINT HOSPITAL

T day

A L SOESI—9 Gynecology
CHARLES A CORDON—9 Gynecology

Thrsday

JOHN SMITH JR—9 General urology
F M F KOCH—9 Pathological anatomy

Friday

JOSEPH S BARDWIN—9 General urology

ST CATHERINE'S HOSPITAL

T day

JOHN M SCANNELL and FRANK D JENNINGS—9 Gynecology

Thrsday

CHARLES A GORDON—9 Gynecology

Friday

MARTIN L BODKIN—9 Rectal surgery
DANIEL A McATEER—9 General urology

BUSHWICK HOSPITAL

T day

HARRY W DANTLER—9 Gynecology
RICHARD C WEITHAS—2 Genito-urinary clinic

Thrsday

NATHAN H ADLER—9 Emergency obstetrics and delivery
W E LIPOLD and S S SCHUSSHEIM—9 Gynecology

GERARD KASPER—2 General surgery

Friday

H WRIGHT BENNETT—9 General surgery

ST JOHN'S HOSPITAL

(Long Island City)

T day

D E McMAHON I L STEIN—2 Obstetrics
J J McMAHON and staff—2 Gynecology

Thrsday

W J LAVELLE S M COHEN and staff—9 Gynecology
G C BONDY and staff—2 Urology

Friday

D E McMAHON I L STEIN and staff—9 Gynecology

JAMAICA HOSPITAL

(Riverside Hill)

T day

H W BARBER—9 General surgical operations
H C COURTNEY—2 Orthopedic operations

Thrsday

L H MOSE—9 General surgery
L VOLZ—2 Urology

Friday

H W NEAL—9 Gynecology
A E BAKER—9 Obstetrics
H C COURTNEY and L VOLZ—2 Fractures and X-ray

JEWISH HOSPITAL

T day

JOHN L NDE—9 Gynecology
LEO S SCHWARTZ—2 Gynecology

Thrsday

JOHN LINDER—9 General surgery
LEO S SCHWARTZ—9 Gynecology

Friday

WILLIAM L NDE—9 General urology
ADAM BONNER—9 Gynecology

HOUSE OF ST GILES THE CRIPPLE

T day

JOSEPH B L EPISCOPO and CHARLES DWIGHT NAPIER—1
Orthopedic clinic

Thrsday

JOSEPH B L EPISCOPO and CHARLES DWIGHT NAPIER—1
Orthopedic clinic

CONEY ISLAND HOSPITAL

Tuesday

- J EARL MILES—9 30 Gynecology
JOHN H CRAWFORD—2 Pre and postoperative care of the cardiac patient
RAY M BOWLES—2 Preparation of the patient in prostate cases
J EARL MILES—2 Miles modification of the Rubin test
ARTHUR C GRAVES—2 Postpartum hemorrhage

Thursday

- GEORGE WEBB and J EARL MILES—9 General surgical clinic
P I NASIR—2 Pre and postoperative treatment of diabetic patients
GEORGE WEBB—2 Traumatic surgery
GEORGE G FISHER—2 Biliary surgery common duct stones

KINGSTON AVENUE HOSPITAL

Thursday

- RALPH F HARLOE—2 Empyemas complicating contagious diseases

FLUSHING HOSPITAL

(Flushing)

Tuesday

- G J J LAWRENCE—9 30 Gynecological operations
J W WICKHAM—9 30 General surgical operations
J L MORRISSEY—11 Gynecological operations
J S THOMAS—11 General surgical operations

Thursday

- J S THOMAS W K ROGERS and J DE R COMBES—9 30 Fracture demonstration
G J J LAWRENCE and J L MORRISSEY—9 30 Gynecological operations

CARSON C PECK MEMORIAL HOSPITAL

Tuesday

- J F RANKEN—9 General surgical operations
O A GORDON JR—2 Obstetrics

Thursday

- T L VOSSELER—9 General surgical operations

Friday

- H T WIKLE—9 General surgical operations

SURGERY OF THE EYE EAR NOSE AND THROAT

CLINICS IN NEW YORK HOSPITALS

BELLEVUE HOSPITAL

Monday

- WILLIAM B DOHERTY and E B GRESSER—2 Eye operations
R T ATKINS—2 Ear nose and throat operations

Tuesday

- JOHN MILLER and E H MOYLE—10 Bronchoscopic clinic
W C BOWERS—2 Ear nose and throat operations
S A AGATSON and E A TUSAK—2 Eye operations

Wednesday

- WEBB W WEEKS E B GRESSER and A E TOWN—9 Pathological eye specimens gross and microscopic
J W FOWLER—10 Postoperative mastoid clinic
JOHN MILLER—2 Laryngological clinic
WEBB W WEEKS WILLIAM B DOHERTY S P OAST and S A AGATSON—2 Eye operations
C J IMPEKATORI—3 Bronchoscopic clinic

Thursday

- WEBB W WEEKS and S A AGATSON—9 Ophthalmoscopic cases
E H MOYLE—10 Anatomical demonstration ear nose and throat specimens
J W FOWLER and V C MCCUAIG—2 Ear nose and throat operations
S P OAST and E A TUSAK—2 Eye operations

Friday

- WEBB W WEEKS E B GRESSER and A E TOWN—9 Pathological eye specimens gross and microscopic
JOHN GUTTMAN—9 Neurotology
EDGAR M POPE and J SWIFT HANLEY—2 Ear nose and throat operations
E B GRESSER and WEBB W WEEKS—2 Eye operations

LIGHTHOUSE EYE CLINIC

Tuesday

- CONRAD BERENS—9 Operations for retinal detachment (lantern slide demonstration)
H J ROSS—10 Relation of dental infections to diseases of the eye (lantern slide demonstration)
PAUL T CONNOLLY and ERVIN A TUSAK—11 Demonstration of unusual clinical and operative cases

Wednesday

- CONRAD BERENS—9 Operations for heterotropia and heterophoria retroplacement resection and tenotomy of inferior oblique (lantern slide demonstration)
LEGRAND H HARDY—10 Practical points in perimetry and campimetry (lantern slide demonstration)
ADOLF POSNER—11 Embryologic interpretation of certain developmental anomalies of the eye (lantern slide demonstration)

Thursday

- JAMES M EVANS—9 Relation of upper respiratory infections to diseases of eye (lantern slide demonstration)
ELIZABETH K STARK—10 Clinical perimetry (lantern slide demonstration)
ERVIN A TUSAK—11 Clinical consideration of ocular tumors

Friday

- CONRAD BERENS and ELIZABETH K STARK—9 Ocular fatigue (lantern slide demonstration)
PAUL T CONNOLLY and DOROTHY KERN—10 Orthoptic training
OLGA SITCHERSKA—11 Keratoconus and contact lenses with presentation of cases

HARLEM HOSPITAL

Wednesday

- L HUBBY—2 Otolaryngology

NEW YORK POST GRADUATE HOSPITAL

Mo d y

ROBERT BUCKLEY—2 Laryngotomy o pharyngotomy
fo m hgn cy
CLAUCE H SMITH and staff— Otologic I pe at
L M ALGE—33 Ey perat add m straton I
ca e
LOUISE H MEEKER—4 Pathology of o nd th at

T day

L H MEEKER—9 Pathologicallnt nld dem nst a
t f eye ca s
C J IMPER TORI—9 B ho c py
M R TN F JOES— H t l m cal x mi at of the
t mp alb e n r l cto
A T R NILSEN— Ethm d i s p t ns
G A LEV ROBINSON—2 D m nst ton f rad m
th pe tic ag t
M R V F JONES nd staff—2 Ot l g cal perat
C M GRIFFITH—3 Caldwell L C d D k perat
MARTIN COHEN—33 Ey pe at nd d m nst
t n f s

H d c d y

JAMES W WHITE a d R AES I—9 Ey rou le op r
t n mus l orales
A CTOR A DE SON—9 N l d ect n nd d m ntr
t n f s r g e lanat my
L AMOND J GAFFNEY—9 Ot l g lop rat ns
ROBERT BUCKLEY— Laryng t my nd pharyn t my
wth m l f hy d pp h f m al g n y
(t s) AUFRECHT— Ribt a pl t f n l d e f nuty
CLAUCE H SMITH d t f f—2 Ot l cal p rat
DVID ALPERIN—33 Lye ope t add dem tra
ti f c

Tl d y

L H MEEKER—9 Pathologicl c d t f the ey
(la te l d e dem st t)
C J IMPER TORI—9 Op q e f gn bod s (la te n
ld d m tat n)
DUNCAN MACHERSON— o Fr nt l us op t
M RVIN F JOE— H st l g cal e ag u t n f th
tempo al bon n l s t ns
A THIL NILSEN—2 C ld well L pe at
C J IM E TORI— E d sc py d l r yng I ope
t s
MAR I F JONES a d t f f— Ot l g l p t
MARTI COHE—33 Ey e op t and d m n t
t f c es

F d y

J W WHITE a d R AE LI—9 Ey muscle p to
m l m l
T J HARRIS—9 Tub c l f l r yng (t e n s l d)
R H HUTCHINSON JR— Cochle d m t a d
estib la t st
E M ALGE—33 Ey op t o d d m tat n f
es

BRONX HOSPITAL

Mo d y

N GOOD IEND—2 Ophthlm lgy

H d c d y

M J BALLIN— Ot laryngology

Th d y

M J BALLIN— Otol r yngology

MANHATTAN EYE EAR AND THROAT HOSPITAL

Mo d y

H W WOOTTON nd L W CRIGER—2 Eye p rat

T e d y

DAVID JONES—3 Ton lcl c
JOHN R PAGE and staff—2 Ea cl c
RO S PAULKNER a d staff— N s a d th tcl c
F M LOV— D m nstrat f r y
A J EGGSTON—2 D m nst ton f p th l o y
H R SKEEL a d G W FREY J— Eye pe t s

H d d y

G ALL V ROBL SO—9 D m t t n fu fr d
n s d th o t m l g n a t t m
DAVID JONES—3 T lcl c
A B DUELL nd staff—2 Ear l c
HARSON SMITH nd t f f—2 N e d th r t l c
E M LOW— N ay d m nstrat n
A J EGGSTON— P th l m cal d mo t t
S C KEIL a d A D MITTENDORF— Ey pe t

Tl d y

C J IMPER O I—o Bo h s p e l c
DA T JONTS—3 T slcl c
E P FOWLER nd t f f— E l c
FRANCIS WHITE a d staff— No a d th tcl
E P FOWLER—2 Clin l r h f
N DEL J FETCHER d J S VAN FLE R— Eye
oper t n

F d y

G ALLEN RO L SON—9 D m tat f e of d m
ea n a d th t b g t m
DAVID JOES—3 T lcl
JOHN RAE— E cl
J E MACKENTY—2 N s nd th r tcl
D H WEBSER a d M COHE— Ey p t s

MT SINAI HOSPITAL

H d

SIDNEY YANKAUE MERVIN MERSON d R DOLPH
KRAMER—2 Bro ch opy
J WOLFF K SCH V A d I GOLDSTE— Ey l

T e d y

I FRIESNE J MAYB UM WA T HOR. S ROSE
JO EPH C DRUSS a d HARRY ROSE
La operat nd d mo t t f c
I GOLDSTEIN— Oc l r p th l g y
SIDNEY YANKAUE MER IN MYE SO a d R DOLPH
KRAMER— N nd th tcl

H d e d y

I F I S E J MAYB UM WALTER HO N S ROE
JOSE H G DRUS d HARRY ROSE
E p rat a d d m trat f s
R LAMBE T— F nd ph t aphy

Tl d y

I GOLDSTEIN— O l p th l g y
SIDNEY YANKAUE MER IN MYE SON d R DOLPH
KRAMER— Bo ch c py
J WOLFF K SCHLICKER a d I G L STEIN—2 Ey cha

F d y

H MINSAY— o Imp d meth d f focal lllumnat
dt n l l m to
SIDNEY YANKAUE MER IN MYE O a d R DOLPH
KRAMER—2 No e a d th tcl n

NEW YORK EYE AND EAR INSTITUTE

Monday

- T LAURENCE SAUNDERS—2 Ear nose and throat operations
 CLYDE S McDANALD and TRUMAN L BOYE— Eye operations

Tuesday

- W W WEEKS WENDELL L HUGHES MARY LANDIS and R E MEEK—9 Demonstration of muscular anomalies visual field changes retinal detachment
 C S DIXON and I SCHWARTZ—10 Demonstration of X ray pictures of mastoid process and nasal accessory sinuses
 B W KEY W B DOHERTY A GRIMALDI B S BEACH and H VAN LAMMERS— Eye surgery
 J MORRISSET SMITH—2 Ear nose and throat operations

Wednesday

- BERNARD SAMUELS A B REESE and E BURCHELL—9 Sympathetic ophthalmics in relation to site of wound traumatism to retina and choroid pigmentation of retina in detachment anatomy of temporal bone
 T B BURCHELL—10 Accessory sinuses relation to orbit (lantern slide demonstration) bacteriology of ear
 FRANCIS W SHINE S I OAST S A AGATSON and JESSIE B STARK—2 Eye surgery
 STUART L CRAIG—2 Ear nose and throat operations

Thursday

- CONRAD BERENS and associates—9 Ophthalmological clinic
 I B BURCHELL Anatomy of the accessory sinus variations and relation to orbit and its contents Discussion by Conrad Berens
 WILLI KNIGHTON Recent advances in cataract surgery with results
 L J BASSEN Glaucoma operations and results
 J MORRISSET SMITH—9 Mastoid operations anatomy of facial nerve (demonstration on cadaver)
 T B BURCHELL—9 Anatomy of temporal bone (lantern slide demonstration)
 JOHN MCCOY—2 Ear nose and throat operations
 W W WEEKS T H JOHNSON W L HUGHES and R E MEEK—2 Eye operations

Friday

- CLYDE E McDANALD and TRUMAN L BOYE—9 Eye clinic
 C S DIXON and I SCHWARTZ—10 Demonstration of X ray pictures of mastoid process and nasal accessory sinuses
 BERNARD SAMUELS CONRAD BERENS ISADORE GOLDSTEIN and WILLIS KNIGHTON—2 Eye operations
 HUGH B BLACKWELL—2 Ear nose and throat operations

LINCOLN HOSPITAL

Tuesday

- J S HANLEY—2 Otolaryngological operations

Thursday

- H K FICGLITT and M BERGER—2 Otolaryngological operations

ST VINCENT'S HOSPITAL

Monday

- JOHN D KERNAN—2 Bronchoscopic clinic

Tuesday

- JOHN M DUFF— Bronchoscopic clinic

PRESBYTERIAN HOSPITAL

Monday

- HARRY NEIVERT—2 Ear nose and throat clinic

Tuesday

- THOMAS H JOHNSON—10 Eye manifestations of brain conditions
 C G COAKLEY—10 Follow up clinic ear nose and throat cases
 JOHN H DUNNINGTON—2 Eye operations
 LEE R PIERCE—2 Ear nose and throat clinic
 JOHN KERNAN—2 Bronchoscopy

Wednesday

- DANIEL B KIRBY—10 Eye tissue culture demonstrations
 HARRY NEIVERT—10 Anatomical demonstration
 GEORGE R BRIGHTON—2 Ear nose and throat clinic

Thursday

- JOHN M WHEELER—10 Results of eye operations
 JAMES W BASCOCK—10 Follow up clinic ear nose and throat cases
 JOHN M WHEELER—2 Eye operations
 CHARLES N HARPER—2 Ear nose and throat clinic

Friday

- JOHN H DUNNINGTON—10 Demonstration of eye muscle conditions
 PAGE NORTHINGTON—10 Studies in deafness
 JOHN H DUNNINGTON—2 Eye operations
 GEORGE V BROWN—2 Ear nose and throat clinic

LEBANON HOSPITAL

Monday

- M D LEDERMAN and ISAAC M HELLER—2 Otolaryngology

Friday

- M D LEDERMAN and ISAAC M HELLER—2 Otolaryngology

METROPOLITAN HOSPITAL

Tuesday

- A L CHAMBERS—4 Surgery of the eye

Thursday

- J A W HETRICK and staff—10 Surgery of the nose throat and ear

KNAPP MEMORIAL EYE HOSPITAL

Tuesday

- ARNOLD KNAPP and staff—2 Eye operations

Wednesday

- ARNOLD KNAPP and staff—2 Eye operations

Thursday

- ARNOLD KNAPP and staff—2 Eye operations

MISERICORDIA HOSPITAL

Tuesday

- ROBERT L BUCKLEY—2 Ear nose and throat operations

GOVERNMENT HOSPITAL

Friday

- WILLIAM I CATEWOOD—2 Nose and throat clinic

MIDTOWN HOSPITAL

Monday

RAYMOND LOSEY—2 Ophthalmological surgery

Tuesday

BENJAMIN FREUDENFALL—9 30 Nose and throat surgery

ST MARY'S HOSPITAL

Wednesday

JAMES W BARCOCK—9 Ear nose and throat conditions in children

CORRECTION HOSPITAL

Monday

JAMES W SMITH—2 Ophthalmic surgery

Friday

JOSEPH ROSENBERG—9 Ear nose and throat clinic

HOSPITAL FOR JOINT DISEASES

Tuesday

ALFRED BRAUN—10 45 Ear nose and throat operations

SPECIAL CLINICS FOR BROOKLYN-LONG ISLAND DAY—WEDNESDAY

BROOKLYN EYE AND EAR HOSPITAL

R L MOORHEAD and staff—9 Operations Simple and radical mastoid sinus operations local and general anesthesia tonsillectomy and adenoidectomy local and general anesthesia bronchoscopy

JOHN N EVANS—9 Fundus cases slit lamp demonstration research laboratory demonstration

DR DEVERE—9 Pathological demonstrations

CHARLES FRANKENBURGER—9 Problems of anaphylaxis pathological specimens old ophthalmological works

GEORGE BARTISCH—9 Old German ophthalmology

JOHN OHLY—9 Lantern slide demonstration

RALPH I LLOYD—9 Ptosis as a diagnostic problem

THURMAN GIVEN and staff—9 Syphilis and the eye

DR DEVERE—2 Pathological demonstrations

Drs CRANE LASHER BRAISLIN COLLINS SCOTFIELD DURKEE ADDONS POOL TUCKER HERBERT CAMERON MCCAMMON AUWERDA and DELOANNA—2 Demonstration of cases of laryngectomy artificial larynx brain abscess meningitis petrositis

R RENDICH—2 Problems of anaphylaxis pathological specimens X ray diagnosis and pathology of the mastoid and petrous pyramid posterior sinuses and optic canal

THURMAN GIVEN and staff—2 Syphilis in children

P CHALMERS JAMESON—2 Recession operation

JOHN OHLY—2 Cataract

JAMES H ANDREWS—2 Glaucoma operations

E CLIFFORD PLACE—2 General ophthalmic surgery

Drs REYNOLDS WAUGH BISHOP BEERY and HARGITT—2 Ophthalmological surgery

ST MARY'S HOSPITAL

Staff—9 Ear nose and throat operations

H F WILKINSON—2 Pathology of 1000 pairs of tonsils

ST JOHN'S HOSPITAL

(Long Island City)

PATRICK J KENNEDY—1 Secondary operation for mastoid new technique in removal of septum

LUTHERAN HOSPITAL

A GILLIGAN P KEIL L M MACDOUGALL G T POLK J E STACK and M SKINNER—9 Ear nose and throat clinic

A GILLIGAN and G T POLK Bronchoscopy nasal sinus surgery ear functional tests

P KEIL and J E STACK Tonsillectomy under local anesthesia submucous resection nasal sinus diagnosis

L M MACDOUGALL and M SKINNER Tonsil and adenoid clinic mastoidectomy nasal surgery

ST PETER'S HOSPITAL

JOHN HAUFF Treatment of the faucial tonsil by physiotherapy

ALBERT KEENAN Conservative treatment of diseases of the accessory nasal sinuses

WICKOFF HEIGHTS HOSPITAL

KARL MUELLER JR—2 Diathermic treatment of tonsils

CUMBERLAND HOSPITAL

F H LASHER and staff—2 Symposium on diseases of the ear nose and throat

NORTH COUNTRY COMMUNITY HOSPITAL

(Glen Cove)

G H COX L T JACKMAN and DR SCOTT—12 Nose and throat clinic

CONEY ISLAND HOSPITAL

T B WOOD Cerebral complications of otitis media

BROOKLYN HOSPITAL

C G CRANE J H TAYLOR and F H LASHER—2 Nose and throat operations

BUSHWICK HOSPITAL

L C MENDER and staff—9 Ear nose and throat operations

CLINICS IN BROOKLYN AND LONG ISLAND HOSPITALS

JEWISH HOSPITAL

Tuesday

EDWARD L BERGER—2 Nose and throat operations

Thursday

EDWARD L BERGER—2 Nose and throat operations

Friday

PHILIP LEIBOWITZ—2 Nose and throat operations

ST JOHN'S HOSPITAL

Tuesday

JOHN P BAKER—2 Otolaryngology

Thursday

JOHN P BAKER—2 Otolaryngology

Friday

ROBERT L MOORHEAD—2 Otolaryngology

WICKOFF HEIGHTS HOSPITAL

T esday

ROBERT L MOOREHEAD—N nd thr tcl c
CARL MUELLER SR—3 Ophthalmological op t n

Tl d y

ROBERT L MOOREHEAD—2 No nd th at cln c
CARL MUELLER SR—3 Ophthalmological op t n

F d y

CARL MUELLER JR—2 N sea dth oat cln c
IRVING C M O—3 N e nd th tcl

CALIFORNIA HOSPITAL

T esday

JOHN W DURKEE—Otolaryngology

Tl d y

JOHN W DURKEE—2 Otolaryngology

LONG ISLAND COLLEGE HOSPITAL

T day

CARL W STICKLEY—Internal medicine
HAROLD S—2 Ophthalmology

CUMBERLAND HOSPITAL

T day

JOHN H BIRCH—Internal medicine
JAMES T—2 Otolaryngology

MARY IMMACULATE HOSPITAL

(J m)

T day

DANIEL CUNNING—N sea dth at cln c

NASSAU HOSPITAL

(M l)

F d

H B S—9 N sea dth at cln c

ST JOHN'S HOSPITAL

(Long Island City)

F d

I J H—9 N sea dth at cln c

LUTHERAN HOSPITAL

T day

A GILICAN—9 Otolaryngology

Tl d y

A GILICAN—9 Otolaryngology
LEON W GREEN—2 Ophthalmology

F d y

LEON W GREEN—2 Otolaryngology

ST PETER'S HOSPITAL

T day

A KENNEDY—2 N sea dth at cln c

Tl d y

M G COLDFE—N sea dth at cln c

ST CATHERINE'S HOSPITAL

T day

S H DECOSTE—2 Internal medicine

Tl d y

GARTH AITE FISHER—E n e nd th at cln c

BROOKLYN HOSPITAL

F d y

C C CRANE—Internal medicine and
Internal medicine

METHODIST EPISCOPAL HOSPITAL

F d y

C J STONE C A ANDERSON F A SUNDF I H
GLIDHILL—Otolaryngology

KINGS COUNTY HOSPITAL

T day

J W DURKEE and M G GOLDEN—9 Otolaryngology

NORTH COUNTRY COMMUNITY HOSPITAL

(Glenn Cove)

F d y

C H C—9 N sea dth at cln c

JAMAICA HOSPITAL

(Rosedale and Hill)

Tl d y

A J SHAFER—Internal medicine

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TUBERCULOSIS OF THE BREAST

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F m th P th l g a l O p t m t f th S y d h m H p i a l

TUBERCULOSIS of the breast is a relatively rare condition when compared with the frequency of tuberculous infection and tuberculous disease in other organs of the human body. Yet it is not so uncommon among the diseases of the breast. In the Mayo clinic from 1904 to 1915 there were 10 cases of mammary tuberculosis reported or 0.51 per cent of all the mammary conditions that had been admitted to the hospital. Of the 1500 cases of mammary diseases that entered the St. Bartholomew's Hospital London 15 per cent were tuberculosis of the breast. H. B. Barker in 1926 stated that although only 15 cases were recorded from the University Hospital it was interesting to note that the department of pathology showed a total of 6 cases of mammary tuberculosis from all sources or one case to each 45 of malignancy. Gatewood found it present in 1.04 per cent of all breast cases which were operated upon at the Presbyterian Hospital of Chicago. These figures compare closely with those of Scott who showed one case of tuberculosis to every 50 cases of carcinoma of the breast. Bloodgood found it present in 6 per cent of the benign lesions of the breast. The rarity of tuberculosis of the breast is therefore apparent rather than real and arises from the condition being overlooked.

In reviewing the literature on this subject I have found more than 439 cases of which 238 cases were primary and 157 were second

ary. 42 were considered doubtful. Almost all of these were proved either by microscopic examination or the finding of the causative factor namely the tubercle bacillus either in the tissue itself or in the pus derived from the lesion or in some cases by both methods substantiated by positive animal inoculation. There also has been a number of other cases reported at an earlier date which had no pathological proofs and which I shall only mention in passing. Furthermore this disease is not limited to the female sex. There has been 20 cases of tuberculosis of the breast in the male including the one reported by me.

The differentiation between the primary and the secondary forms is rather a difficult problem. We must consider a case primary if there is a complete absence of a previous history of tuberculosis involving any part of the body (i.e. lungs, glands, bones, etc.). Furthermore on examination in a particular case there must be absolutely no evidence of the presence of either a latent or active tuberculous focus except in the involved breast. A secondary case is one in which the patient at some time or other has had evidence of a Koch infection or still has an existing tuberculosis in some other organ. As there is no record of a patient coming to necropsy with tuberculosis confined to the breast, absolute proof of a single case of primary tuberculosis arising in the mammary gland is still lacking. Gatewood in 1916 suggested that those cases

like tuberculosis of the kidney might be said to be deuteropathic in the sense that the lesion is secondary to some unrecognized focus elsewhere in contradistinction to the exceptional case which may really be primary or protopathic.

In his famous work on diseases of the breast Sir Astley Cooper in 1829 was the first to recognize mammary tuberculosis as a clinical entity. He spoke of this condition as a scrofulous swelling of the breast. However Virchow at a later date denied that the breast is vulnerable to tuberculosis. Nelaton in 1839 recognized the fact that mammary tuberculosis might occur as the only lesion of its kind and owe its existence not to a contiguous process or to a more distant lesion of like nature but to sources apart from these. Berard reported a case in 1842 but gave no new data and no pathological proofs. In 1851 Heyfelder was the first to report a case in the male. Johannet in 1853 reported a case in a woman who also suffered from tuberculosis of the lung. Velpeau in 1854 reported 4 cases and distinguished three forms of the disease namely disseminated tuberculosis lymphatic tumors and lymphatic degeneration. Givaldes in 1854 and Bauchet in 1857 discussed the condition but did not add anything new to the problem. Lancereaux in 1860 described a case and was the first to base his diagnosis not only on clinical findings but on the microscopic appearance of the breast tissue. Bazin mentioned the subject in his *Lexicon sur la Scrofule* in 1861. Cunco in 1863 described a case occurring in a male and I believe was not only the first to have isolated the organism from the pus but was also the first to have practiced successfully animal inoculation with positive results. Jamma in 1870 cited Velpeau and also concluded that this disease must be extremely rare. Other authors such as Holmes, Voilemier, Robert and others discussed this condition but contributed no new details. Horteloup in 1872 reported another case in the male but gave no pathological proofs. Koster in 1873 stated that he found macroscopically a distinct tubercle in a case of mammary abscess. Eric Ericson in 1874 mentions in passing Velpeau's work on breast tuberculosis. Leger in

1878 reported a case of breast tuberculosis in a woman who died of a generalized Koch infection. He however gave no pathological proofs. Billroth and Richet discussed the subject thoroughly in 1880 and Klotz during the same year reported 3 cases 1 of which was primary. One of his cases was proved with microscopic examination.

The second epic in the study of mammary gland tuberculosis began with the presentation of Dubar's thesis in 1881 when a diagnosis was based not only on a histological examination but also on the finding of the tubercle bacillus in the tissues. He reported 2 new cases and described two forms of the disease namely the isolated or disseminated nodular type and the confluent type. He regarded the first form as more apt to be primary in the breast. His report established the first definite criterion for the microscopic recognition of tuberculosis of the mammary gland. Following this dissertation many more authors published and described cases of breast tuberculosis among which were Duret in 1882, Crandall in 1883, Poiner in 1883, Ohnacker in 1883, Durante in 1884, Orthmann in 1885, Habermass in 1886, Souplet in 1886 and Mollier during the same year. Piskacek published 8 cases in 1887 two of which were primary. It now became recognized as a distinct clinical entity so that authors began to look for this condition among the diseases of the breast and numerous cases were reported as outlined in the tables to follow.

Roux in 1891 gave a complete review of the cases with 3 additional cases in which he was successful in isolating the organism. Furthermore he described the third form of the disease which he called intraglandular cold abscess. Robinson in 1892 considered the mode of origin of this disease concluding that it was not primarily an infection of the glands proper but first of the connective tissue and later of the gland epithelium the evidence being in favor of a lymphatic or hæmatogenous origin rather than a duct infection. In 1893 Remy and Noel published the report of a case of this disease occurring in a woman aged 53 years the most advanced age recorded to that time. Powers in 1894 reported 35 collected

cases and showed that the disease was evenly distributed in the third fourth and fifth decades of life. He found that 21 of the 22 married women had borne children and 9 had given a history of previous inflammatory changes in that breast. He volunteered the belief that the puerperal state and subsequent lactation were not without predisposing influences upon the cause of the disease. Sabrazes and Binaud in 1896 gave a most complete pathological and histological resume of tuberculosis of the breast together with a review of the literature. Freiberg in 1898 and Smith in 1902 reported cases that seemed examples of secondary involvement of the breast by extension from the axillary glands through the lymphatics to the breast tissue.

There is a good deal of controversy in regard to the mode of infection in cases of mammary tuberculosis. The possible paths of infection are (1) through the ducts (2) through a surface wound (3) through the blood stream (4) through the lymphatics and (5) through the contiguity of structures.

The possibility of the entrance of the specific organism into the breast through the nipple and the ducts is rather a remote one. The skin rarely harbors the Koch bacillus in a viable state for any length of time. A number of cases have been reported in which infection took place in this manner. Ingier cites a case in which the inflammation was confined to the walls of the excretory ducts and the periacinous tissue the interacinous tissue being only slightly involved. Ely in 1890 mentions a case in a woman who had covered her breast with a piece of linen that was contaminated with tuberculous sputum and soon after developed tuberculosis of that breast. He believed that the bacilli had been carried into the openings of the galactiferous ducts through the nipple. Rodman believes that inasmuch as the lesions are more pronounced in the alveoli than in the ducts and furthermore as the ducts are not more diseased at their exit at the nipple than in the substance of the gland it is questionable whether infection through the ducts is common. Gatewood however states that this does not necessarily follow as tuberculosis of the tongue is very rare, and the process when

present begins in the muscular septa in spite of the fact that the glands and the mucosa of the tongue are areas which are most frequently exposed to the tubercular organism. The case of the male which I am reporting in this paper is no doubt a distinct example of this mode of infection. His habit of pinching his nipples for the peculiar 'twang' which it gave him was instrumental in the infection. The histological examination of the specimens showed distinct evidence of tuberculosis in the excretory ducts.

It is quite plausible that accidental infection may take place through a surface wound of the breast. This lesion might be tuberculous from the very beginning or become secondarily infected with tuberculous sputum. Fricke in 1907 reports a case in a woman 56 years of age who had no tuberculosis elsewhere in the body but complained of a small lump in her breast. Her husband who had pulmonary tuberculosis massaged the growth with ointments and when the breast was removed it showed carcinoma and tuberculosis. Fricke believed that the tuberculosis was implanted by her husband and therefore must have been secondary to the carcinoma. The infection might have taken place either through the ducts or through the skin. Ravenel has shown that the tubercle bacillus is able to pass through the skin or mucosa without leaving any signs of its invasion.

The majority of investigators have considered that mammary tuberculosis is of hematogenous origin. That of course would be the most simple explanation of a primary infection in the breast. It is rather difficult to understand why the organism after having gained its entrance in the blood stream should localize itself in the breast tissue an environment least conducive to its growth and multiplication. Furthermore it would preclude that there must have been a primary focus elsewhere in the body from which source the organism had entered the circulation. This in itself would make all breast tuberculosis secondary to other foci. Nagasaki in 1925 reported 34 cases of disseminated tuberculosis of the miliary type which had come to autopsy. He made sections of all suspicious breasts but did not find tuberculosis in any of the cases.

He concluded that a hematogenous infection of the breast with tuberculosis must be extremely rare in that the breast appeared to be the only organ that was spared in his series of cases. He further made a bacteriological examination of these breasts and failed to show the organism. He also injected the mammary extracts into guinea pigs and could not induce tuberculosis in any of the animals.

Halstead and LeCount state that in about 75 per cent of the cases reported there was a tuberculous adenopathy affecting the axillary glands on the same side as the breast lesion. Many authors were of the opinion that the majority of cases of mammary tuberculosis were the result of a retrograde lymphatic involvement from the axilla or from some intra-thoracic focus. This belief was based upon the observation that in a number of instances the involvement of the axillary nodes seemed definitely to precede the mammary involvement and this opinion is strengthened through the recognition of the intimate relationship of the mammary gland to the axillary and mediastinal lymph nodes. Illustrative of this point is the interesting case of Duvergey quoted by Deaver. This patient while washing the linens of tuberculous patients abraded a finger of her left hand. The wound suppurated for 2 weeks and then healed completely. Eight months later she noticed a swelling in the left axilla which was incised and from which pus was evacuated. The wound did not heal and 3 months later a painful lump appeared in the left breast. This was drained from time to time, other sinuses developing in the breast during the treatment. The lungs eventually became involved and the tubercle bacillus was isolated in the discharge from the sinuses. Here the evidence strongly points to a retrograde lymph vascular infection. Scheidegger describes a case of carcinoma and tuberculosis in the breast of a woman 37 years of age. The axillary glands were tuberculous but not carcinomatous. He believed that the carcinoma of the breast was primary but the tuberculosis was secondary the primary focus being in the axillary glands. Fischer in a similar case in a woman aged 69 years reported the finding of tuberculosis in the axillary glands and a lump in the breast. Amputation showed a car-

cinoma of the breast with secondary tuberculosis originating from the axillary glands. In 8 cases of the 37 reported by Berchtold the disease was primary in the axillary glands and secondarily involved the mammary gland. This was regarded by Verneuil as the usual mode of infection of the breast. However it may be said that the primary focus in the breast in many cases escapes notice until after the axillary glands are considerably involved. Again the disease in the axillary glands when secondary usually advances with greater rapidity than that of the mammary gland so that while the axillary glands may be broken down and suppurating the nodule in the breast may remain stationary for a considerable length of time. Fuller maintains that the demonstration of the origin in many cases of tuberculosis of the breast is therefore the purest guess work and will be an impossible task unless the disease is plainly a continuous process from some nearby organ or tissue. Reenink also believes that most cases of tuberculosis are secondary to axillary tuberculosis. In Johannet's case which came to autopsy there was a subpleural tuberculosis which had extended to the axillary glands and then to the breast. Duret in 1882 was the first to recognize this mode of infection and described a case in a woman 3 years of age who since the age of 12 had enlarged glands of the axilla which after marriage gradually enlarged to the size of an apple and then extended via an indurated cord like infiltration involving the breast on the same side. Raw cited the case of a girl aged 19 years who was admitted to the hospital with very extensive tuberculosis of the right glands of the neck. She had been brought up in Canada and had used very large quantities of unsterilized milk in the previous 12 years. The infection had spread by direct lymphatic extension to the axillary glands which had suppurated and thence to the breast which was in a condition of generalized tuberculous mastitis with 5 sinuses discharging a large amount of pus daily. He concluded that mammary tuberculosis is never primary but is the result of a lymphatic extension from the glands of the neck or axilla excepting in rare cases of generalized miliary tuberculosis. He furthermore

believed that it was caused by the bovine bacillus. Gatewood stated that in the light of recent observation upon the occurrence of localized infections caused by blood borne organisms it would seem that almost all cases of tuberculosis of the breast are but secondary manifestations of a tuberculosis elsewhere. In reviewing the cases of breast tuberculosis dis regarding whether they were considered primary or secondary by the authors I found that among the 439 cases reported including my own 6236 showed distinct axillary involvement. These figures are not exact as some authors failed to mention whether the glands were involved or not therefore in view of the relative frequency of tuberculous adenitis when compared with tuberculosis of the breast it is most probable that the majority of cases are due to a retrograde lymphatic involvement either from the axilla or from a primary focus in the thorax by the way of Grossman's path and Rotter's lymph nodes. Furthermore I do not believe that it is possible to rule out completely a tuberculous focus in the lung even if the patient has been subjected to a most thorough physical examination including roentgen examination of the chest. It is a well known fact that the majority of people are infected with the Koch bacillus but not diseased. These organisms no doubt may remain in the body for a long time in a latent state and suddenly become aroused into activity due to a diminished local resistance in some particular portion of the body. The lymphatic glandular system about the hilus of the lung is known to have harbored these organisms over a long period of time causing little or no symptoms. It is quite plausible then that the infecting agent may pass from this locality through a retrograde process via the lymphatic system and reach the breast. The history and subsequent changes found in mammary tuberculosis certainly points toward this manner of infection.

Infection via the contiguity of tissues is a mode of infection readily understandable and requires no further elucidation. A number of cases in the literature have been reported in which the process spread from a diseased rib or a tuberculous caries of the sternum.

A number of authors among whom are Raw and Barker have come to the conclusion that most cases of mammary tuberculosis are caused by the bovine tubercle bacillus. Barker in 1926 stated, "All cases in which the type of the bacillus has been determined were proved to be of the bovine type but the number of cases from which the bacilli have been cultured is much too small to warrant conclusions. If we bear in mind that the bovine bacillus has a predilection for the lymphoid tissue of the human body it is not surprising that tuberculous mastitis is caused by this particular type of organism especially if we consider that the path of infection is through the lymph channels from the glands of the axilla. However the so called secondary cases in which the primary lesion is in the lung are more apt to be due to the human type of the tubercle bacillus."

Among the etiological factors in breast tuberculosis it appears that trauma plays a very minor part. We must bear in mind that due to the anatomical position of the breasts they are naturally exposed to injury at frequent intervals yet among the 439 cases reviewed only 32 gave a history of some form of injury. This is only 7 per cent. If injury is to be considered a factor in predisposing an area to tuberculosis by reducing the tissue vitality then the breast is just as liable to this infection as any other organ particularly when there exists a tuberculous focus elsewhere in the body.

Heredity also plays no great part as a predisposing factor. Only 13 per cent of the cases reported gave a history of tuberculosis in the family. There is not a doubt that it plays a greater part in the so called secondary forms where the patient has or had pulmonary tuberculosis. Here heredity plays the same part as it does in phthisis.

Breast tuberculosis is more frequent during the active sexual period of life. It is therefore found in the second, third, and fourth decades. It is extremely rare before the tenth year and fairly uncommon after the age of 50 years. After making a thorough survey of this particular angle I was able to accumulate the following data:

Of the 439 cases reported in the literature the youngest patient was that of Demme who

reported finding mammary tuberculosis in a male infant aged 6 months. This was proved with microscopic examination and the finding of Koch bacillus in the tissue and further borne out by positive animal inoculation. No cases were reported between the ages of 1 and 10. One hundred twenty seven cases occurred between the ages of 20 and 30. An almost equal number i. e. 231 occurred between the ages 30 and 40. From there on the frequency diminished. Only 83 cases of mammary tuberculosis were recorded between the ages of 40 and 50. 32 were found between the ages of 50 and 60. 9 between the ages of 60 and 70. and 2 between the ages of 70 and 80. The oldest was the case reported by Shield a woman 73 years old. In conclusion therefore it may be said that the greatest age incident of mammary tuberculosis is between 20 and 40 years. This is very important to bear in mind and should be an aid in differentiating mammary tuberculosis from mammary carcinoma.

There is a slight tendency for the right breast to be more frequently affected than the left. Two hundred and four cases showed right breast involvement whereas only 175 showed left breast involvement. Nineteen cases had bilateral involvement.

There is no doubt that the marriage state with the consequent puerperium and lactation plays more or less an important part as a predisposing factor in breast tuberculosis. In this series I noted that 285 had been married of whom 180 had borne children. Only 81 cases of breast tuberculosis occurred in single women. However we must consider that the greatest majority of women between the ages of 20 and 40 are married and that is just the age that mammary tuberculosis occurs with greatest frequency.

There is no one single pathognomonic symptom or sign of mammary tuberculosis but taken all together they present a fairly distinct picture which in most cases should lead to a correct diagnosis. I certainly disagree with Fuller who in 1909 stated. Taken as a whole nothing is so misleading about disease in general as symptoms and this applies abundantly to tuberculosis of the breast. The symptoms in no two cases are the same.

No two patients describe symptoms alike and no two observers construe them alike. One of the most important symptoms that the patient complains of and the very first he or she notices is a lump in the breast. This was the first thing that 290 patients noticed of the 439 cases here reviewed. This sign had occurred long before they had observed any discomfort or pain. The other signs and symptoms usually vary with the type of the infection and the course which it takes. Barker in 1926 classified this disease clinically as follows (1) breast tuberculosis with rapid evolution (2) breast tuberculosis with slow evolution and (3) sclerosing type or pseudoneoplasm.

The lump usually occurs in the upper and outer quadrant of the breast. It may be present for a long time before the patient consults a physician. As long as it is stationary it is usually neglected only when it begins to increase in size and begins to give some pain is it brought to the attention of the patient sufficiently for them to consult their doctor. In this series 132 had noticed this lump for 6 months or less. Ninety seven had noticed the presence of a lump for more than 6 months. It had been present in one case as long as 8 years and in another almost 14 years. This mass in the breast is usually insidious in its onset and free from pain until it distends the surrounding tissues with its growth or the overlying skin becomes involved. A characteristic feature of the disseminated nodular type is the extreme chronicity of its process and its painless and insidious development. The breast is usually not enlarged and on palpation masses are felt resembling small adenomata. The confluent type occurs as a further step in the pathological process and this variety shows a more acute course. This form is frequently seen in the lactating breast. The skin over the involved area becomes tense and reddened and the patient begins to complain of severe pain due to the distention of the underlying tissues. It usually breaks through and a fistula forms discharging a thick cheesy pus. This may persist over a long period of time until the infection spreads and other fistulae form either connecting with the first or originating from other broken down areas in the breast. The sclerosing type of tuberculous mastitis seen

most frequently in elderly women is similar to the fibroid type of tuberculosis found elsewhere in the body. Here the breast is apt to be distorted and the nipple retracted and the lesion if palpable is of firm consistency. This form has been very aptly called the tuberculous pseudoneoplasm of Chauvin and can very easily be mistaken for a scirrhous carcinoma. The disease may take this form either because of low virulence of the infecting organism or because of the greater resistance of the host. It spreads rather rapidly to the axillary glands and although the process in the breast appears to be more or less stationary the axillary glands rapidly go on to caseation. The intra-glandular cold abscess of Roub is usually a terminal product of the confluent form of tuberculosis which has not broken through because of its deep seated location. In several cases the earlier symptoms and the course of the mammary involvement varied from the usual form. In Orthmann's case it began apparently subcutaneously and resembled an ordinary furuncle. In Poirer's case it began as a number of vesiculated pimples with indurated bases. In Kramer's an ulcer first appeared near the nipple later nodules formed within the breast and were connected to the ulcer by bands of indurated tissue.

Pain as an early sign in breast tuberculosis is fairly uncommon. It occurred in only 6 per cent of the cases reviewed. It is present in almost all the cases when the mass has grown sufficiently or has broken down. Retraction of the nipple is fairly rare and is found only in those cases in which the tuberculous process occurs in or around the areola and also in the so called scirrhous form of breast tuberculosis in which the process is of long duration and of low virulence. Here it depends upon the excessive formation of connective tissue and its retraction with resultant deformity of the nipple. This symptom is the one that frequently leads to the mistaken diagnosis of carcinoma of the breast. A few patients complain of a distinct tenderness in the nipple occurring when it comes in contact with their clothing and causes them extreme annoyance.

Swelling of the glands of the axilla involving the same side is one of the most frequent signs of mammary tuberculosis. This is noticed in

many cases even before the patient's attention has been attracted to her breast. It may precede the breast involvement by many months but is usually not sufficiently annoying to bring the patient to her physician. The axillary lymph nodes may or may not be the seat of tuberculosis. A palpable gland does not necessarily mean tuberculosis nor does a non palpable node mean the absence of tuberculosis. Of the 439 cases reviewed 236 showed glandular involvement many of which were positive for tuberculosis on histological examination. This certainly points to the possibility that the infection arises there and involves the breast secondarily. The glands frequently go on to earlier suppuration while the mass in the breast remains more or less stationary.

Contrary to the statement of many authors that this disease affects only the spare weakly anæmic individuals of the so called scrofulous diathesis, I found that the greatest majority of cases occurred in women of robust character who had always maintained an excellent state of health. However this holds good only for the so called primary type. The secondary form of mammary tuberculosis does occur in those patients who have a predisposition to tuberculosis and in whose family there is a history of tuberculosis. Two hundred and twenty eight were in good health 66 were in fair health and 69 were in poor health, the latter occurring only in those cases who had other active foci of tuberculosis.

The course of the disease is usually a progressive one and the rapidity of its progress is greatly dependent upon the type and pathological form that the disease takes. No case is known to have undergone spontaneous regression after it once has started. In this manner it differs from phthisis. It is therefore purely a form of surgical tuberculosis and always requires intervention. The nodular type may remain stationary for years but once it begins to advance there is a steady increase in the size of the tumor. The confluent type shows a more acute course with early breaking down and abscess formation. Here it may be a question of weeks especially if it occurs during the lactation period. In this form it frequently spreads toward the axilla with which it is joined by masses or bands of indurated tissue.

This occurred in the cases of Mandry Piskacek Hebb and others. Without intervention the process continues by extension involving new areas before the older ones have healed and death more or less slowly advances when the disease is left to itself particularly through the involvement of the thoracic viscera. Vandel in 1927 stated that the average duration of the disease varied from 10 to 12 months in the primary cases to 11 to 12 months in the secondary cases. On the whole mammary tuberculosis pursues a more rapid course than mammary carcinoma.

There are few or almost no complications in mammary tuberculosis except that the disease is left to itself continually progresses invading the neighboring organs.

Tuberculosis of the breast is sometimes associated with other diseases of the breast. Among the cases reviewed about 5 showed the presence of adenomata a number showed fibro adenomata and over 15 showed carcinoma. The latter is of great importance as it may be overlooked and a conservative operation be performed with the belief that we are dealing only with a Koch infection. The interpretation of their relationship is of great interest as several possibilities exist.

1 The two conditions may occur independently of one another either simultaneously or consecutively.

2 The tuberculosis may be engrafted upon the malignant process as a result of the breaking down of the tissue with a resultant increased susceptibility of the area to tuberculosis.

3 The carcinoma may be the result of the chronic irritation of the tuberculous inflammatory process.

In the case of Smith and Mason the carcinoma seemed to be the lesion of longer duration as it was a typical scirrhous type for the most part and the tuberculous lesion showed no calcification. It thus suggests the second possibility cited that of a tuberculous process superimposed on a degenerated malignant disease. Bundschuh in 1913 discussing the association of these 2 conditions is of similar opinion as Smith and Mason. Other authors among whom are Klose Fricke Scheidegger Kallenberger Moak Schifone etc reported

similar findings. The doctrine set forth by Rokitsansky that carcinoma and tuberculosis are never found in the same patient and as later modified by Dietrich and Martius that both of these processes never appeared in the same organ has long been exploded. Friedlander Wolfe and Schwalbe have described the occurrence of carcinoma in lung caverns in case of chronic pulmonary tuberculosis. Tubarsch found multiple carcinomata of the pleum showing tuberculous infiltration and metastatic carcinoma in areas of fresh tuberculous infiltrations of the lung.

The correct diagnosis of tuberculosis of the breast is of utmost importance and its early recognition may save the patient from a radical operation. It cannot be stated in better words than those used by Manley. To one advanced in years the pathetic deformity following the clearing away of an atrophic non functioning breast is a matter of little consequence but to the young unmarried woman it is on the contrary most serious for she is no longer a complete woman stripped of Cupid's most inestimable adornments. Furthermore its accurate detection at once relieves the patient of the dreadful apprehension of cancer and leads to a safe and radical measure of treatment devoid of danger to life. The clinical findings are not always sufficient to aid the physician to make a correct diagnosis. A lump in the breast of long duration not associated with pain or retraction of the nipple but associated with glandular enlargement is very suggestive. If to this is added the presence of a fistula discharging a gritty caseous material one can fairly safely make the diagnosis of breast tuberculosis. Fistulae are present in about 50 per cent of the cases and are quite characteristic of this condition. The demonstration of the bacillus in the discharge or in the tissue is accomplished with great difficulty. Mammary tuberculosis belongs to the group known as the bacillary poor processes. Piskacek was able to find only a few bacilli in 400 preparations and of the 79 cases collected by Deaver the bacilli were found in the stained sections only 7 times and in the preparations of pus only 4 times. In my review I found that the organism had been isolated in about 100 cases which is about 5 per cent of the cases.

reported. This is no doubt due to the better methods now employed and the more improved staining procedures.

Breast tuberculosis must be differentiated from a number of other conditions that may give a similar picture. Among these are chronic mastitis, cystic mastitis, the so called galactocoele, fibroma, adenoma, sarcoma, and carcinoma. The first five conditions mentioned usually show no glandular involvement. Sarcoma grows with much greater rapidity and is extremely rare. Pain is usually a very prominent symptom, and the cutaneous veins of the breast are usually greatly dilated and engorged. In adenofibroma the growth of the tumor is very slow as in the nodular variety of tuberculosis but differs from it in that the former is freely movable in the breast. Carcinoma of course is rather difficult to differentiate from breast tuberculosis. Even in cases in which there is a distinct fluctuation one cannot rule out cancer as this tumor may undergo central softening. However it usually occurs at a later age, it frequently causes deformity of the nipple with some retraction, and the patient complains of pain. The safest procedure in the differential diagnosis is the removal of a small portion for histological examination.

The prognosis in mammary tuberculosis is excellent if the diseased area is completely eradicated. Braendle in 1906 reviewed a number of cases and showed that there were no recurrences except in a single case in which the operative intervention was much too conservative.

The following methods of treatment have been employed in the cases reviewed: (1) curetting of the sinus, (2) cauterization of the sinuses, (3) injection of the sinuses and cavities, (4) incision and aspiration of abscesses, (5) removal of the tumor alone, (6) removal of the axillary glands alone, (7) removal of the tumor and portion of the breast, (8) removal of the breast completely, (9) removal of the breast and axillary gland.

I personally believe that the treatment depends upon the individual case. With early involvement and early diagnosis the more conservative operation may be all that is necessary to save the patient.

The pathology of breast tuberculosis is similar to the pathology of tuberculosis elsewhere in the body except for some variations due to the histological structure of this organ. The pathological changes may pursue certain forms and these are best classified as follows: (1) acute milary tuberculous mastitis, (2) nodular tuberculous mastitis, (3) disseminated nodular tuberculous mastitis, (4) confluent tuberculous mastitis, (5) intraglandular cold abscess, (6) sclerosing tuberculous mastitis, (7) tuberculous mastitis obliterans.

In the acute milary tuberculous mastitis the breast is affected in a similar manner to other organs of the body. This form is comparatively rare as has been shown by Nagasaka. The breast appears to be the organ most frequently spared in milary tuberculosis.

The nodular tuberculous mastitis is the most frequent form of breast tuberculosis. The organism having gained entrance into the breast excites a local reaction with the formation of a discreet tubercle. This tubercle is usually situated in the connective tissue and rarely in the wall of the duct or periductal tissue. The lymphocytic infiltration usually extends and involves the acini causing a destruction of the glandular elements. It usually enlarges very gradually until it forms a mass the size of a hen's egg or even larger. There is still some controversy whether the initial lesion occurs in the stroma or in the acini. On section of the individual nodule we find a bluish grey mass with a central wax colored caseous material which does not convey the gritty sensation as is commonly found in carcinoma. On microscopic examination there is revealed a mass of caseous substance surrounded by lymphocytic infiltration, epithelioid cells and a number of typical Langhans giant cells with peripherally located nuclei. The caseated material may be either firm or have undergone liquefaction. When this takes place it usually seeks an outlet with the formation of a sinus. As a rule this nodule remains unattached to the skin until the sinus tract forms. If it happens to occur in the areola it may cause retraction of the nipple. This lesion may remain dormant for a long time and then suddenly begin to grow and involve adjacent areas.

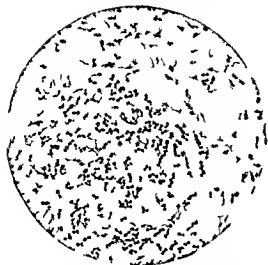


Fig. 1. g d c eet tub cle bef seat h
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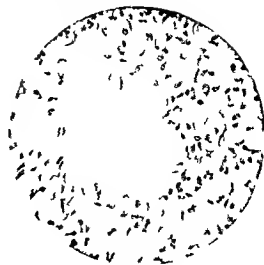


Fig. 2. A f fl t t b culo how g th pe
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The disseminated nodular tuberculous mastitis is just a further step of the simple nodular type with the formation of daughter tubercles from the original mother tubercle. After they break down they usually form multiple sinuses draining individual abscess cavities. It is more a rule in its progress and frequently attacks lactating breasts. There is a good deal of destruction of the breast tissue. With coalescing of the individual tubercles we come to the fourth variety of confluent tuberculous mastitis.

The breast in the confluent type is usually enlarged. On section one finds irregular cavities communicating with each other and filled with a grumous necrotic cellular debris. In the walls of the cavities varying sizes of tubercles are seen, also arising from the walls are fringes and villousities of necrotic material. The membrane lining these cavities is greyish in color. From lactiferous ducts adjacent to these areas there may be expressed grumous material similar to that found in the cavities. On microscopic examination of such areas one notes a center of amorphous hyaline material surrounded by a number of giant and epithelioid cells between which there is a proliferation of new connective tissue and thin walled blood vessels. Fistulae usually connect these cavities with the exterior.

The intraglandular cold abscess is nothing more than a deep seated confluent tuberculous mastitis well walled off from the exterior in a more or less quiescent stage. The process is slower in its progress but gradually works its way toward the surface to form a fistulous tract. The necrotic material may undergo encapsulation and hyalinization.

The sclerosing type of tuberculous mastitis is a very slow progressive lesion and is easily mistaken for scirrhus carcinoma. The breast is usually not enlarged, but there are a number of very hardened nodules which tend to be attached to the underlying structures and even to the skin. It usually causes retraction of the nipple because of the increased formation of connective tissue. The acini are destroyed and replaced by fibrous tissue. There is usually a diffuse lymphocytic cellular infiltration accompanied by epithelioid and giant cells but very little caseation. The individual tubercles tend to heal and undergo hyalinization but new daughter tubercles form. The breast may shrink to half of its normal size. The axillary glands become involved early and may undergo caseation. This type is usually due to the low virulence of the organism and has been compared to fibroid phthisis because it is also found most frequently in elderly people. Sinuses are of rare occurrence and the differen-

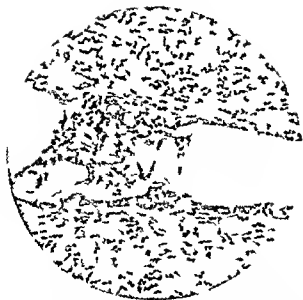


Fig. 3 Tuberculosis affecting one of the galactiferous ducts showing the typical Langhans giant cell Case 1

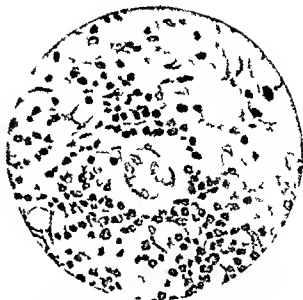


Fig. 4 High power discrete tubercle showing typical giant cell Case 1

tiation between this form and carcinoma is extremely difficult

The tuberculous mastitis obliterans is a variety of mammary tuberculosis in which the lesions seem chiefly to surround the milk ducts destroying the epithelial linings filling the lumens with products of tuberculous transformations and finally obliterating them. One must be careful not to mistake certain forms of mastitis for tuberculosis. In these cases due to the obliteration of the ducts material containing lipoids become stagnated and excite the formation of foreign body giant cells or the so called pseudoxanthoma cells.

SUMMARY

In summarizing this subject certain outstanding features must be kept in mind some of which are as follows

- 1 The rarity of tuberculosis of the breast is apparent rather than real and arises from the condition being overlooked

- 2 The classification of mammary tuberculosis into primary and secondary forms is fundamentally unscientific in that there is no absolute criterion and proof whether a case is primary or not even if there is no clinical evidence of tuberculosis elsewhere in the body

- 3 The most plausible mode of infection is via the lymphatics through a retrograde process the original site being either in the glands

of the neck or the glandular tissue about the hilus of the lung

- 4 It occurs most frequently during the active sexual period of life

- 5 Its symptoms are varied the most frequent being a lump in the upper outer quadrant associated with axillary involvement but no pain until it enlarges sufficiently breaks down and forms a fistulous tract

- 6 The prognosis is good with early recognition of the disease and its eradication by surgical intervention



Fig. 5 High power of area showing tuberculous involvement of one of the ducts Case 1

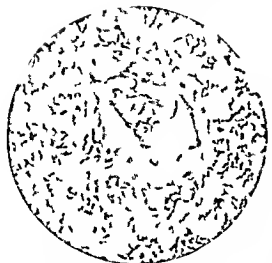


Fig 6 T b clew th b g leficat n nd f on
b dygant ll C 4 Ch rt N 93 4

7 The pathology is similar to pathology of tuberculosis elsewhere in the body except for some minute differences due to the histological structure of the breast.

The following cases of which there are 5 female and 1 male were treated at the Sindenham Hospital

CASE REPORTS

CASE 1 Mrs A L No 0202 m red aged 43 years admitted to the hospital June 9 1929 with a diagnosis of carcinoma of left breast. She complained of a painful lump which she first noticed 4 weeks ago associated with a marked sensitivity of the left nipple to touch. This lump had progressively enlarged until her entrance to the hospital. Her past personal history was unimportant except for a hysterectomy and appendectomy 10 years previous. Physical examination showed a well developed female adult. There was absolutely no evidence of any pathology except in the involved breast. There was a mass the size of a small orange in the lower outer quadrant of the breast. The skin over it was erythematous but not adherent. It was quite tender to touch. The glands of the left axilla were distinctly palpable. A radical mastectomy was performed with division of the pectoralis major and minor and with dissection of the axillary glands. The wound was closed in the usual manner. The mass of neoplastic tissue was about 3 inches in diameter located external to the nipple. It was firm in consistency but some areas showed evidence of broken down necrotic material. Section made from numerous blocks of the breast showed varied pictures. Some areas showed evidence of chronic cystic mastitis and other areas showed diffuse necrosis with lymphocytic infiltration and still other sections showed a

perfectly typical picture of tubercles with central areas of caseation surrounded by epithelioid and giant cells.

CASE 2 Mrs H H No 801 married aged 33 years was admitted to the hospital on February 20 1928 suffering from a small tender mass in the left breast which had broken down and was discharging. She first noticed this in June 1927 when the mass was the size of a bean and was located in the upper outer quadrant of the left breast. It was attached to the skin but caused little discomfort and was therefore ignored. A few months previous to her entrance to the hospital the mass appeared larger and began to discharge. The patient had received X-ray treatments and following the treatments the mass broke down and another mass appeared which simultaneously broke down and discharged. Wet dressings were applied and finally curettage was resorted to with no amelioration of the symptoms. An operation was performed and microscopic examination revealed the following: The breast tissue showed marked fibrotic changes with the bands of connective tissue surrounding the individual lobules and penetrating the same. This resulted in pressure atrophy of the individual glandular elements. Other areas showed diffuse lymphocytic and small round cell infiltration on among which numerous plasma cells were to be found. Other areas however showed distinct tubercle formations with central areas of necrosis surrounded by small round cell epithelioid cells and on the outer borders by the typical giant cells of Langhans type with their nuclei arranged along the periphery of the cell bodies.

CASE 3 Mrs E S No 15031 married aged 50 years was admitted to the hospital on September 10 1930 complaining of a lump in her left breast. Examination on revealed no evidence of any pathological changes anywhere else in the body. Operation was performed and a tumor was shelled out. The gross appearance was that of a gynecoma. Microscopic examination revealed a typical picture of tuberculous mastitis.

CASE 4 Mrs R K No 9384 aged 39 years married was admitted June 16 1919 with a diagnosis of tuberculosis of the left breast. Patient complained of pain in the left breast for the last 3 weeks and also noticed that a hard lump had formed. The pain gradually diminished but the lump grew in size. The patient had been nursing her baby for the past 10 months and still had milk in both breasts. This patient had three children. Complete examination of the patient was negative except for the local condition. This showed a hard lump about the size of a walnut in the outer and upper quadrant of the left breast. There was no involvement of the axillary glands. The patient was operated upon and excision of the tumor was performed. Pathologic examination on revealed very little normal breast tissue left. The whole breast was composed of many tubercles with necrotic areas and a diffuse cellular infiltration among which were epithelioid plasma and giant cells.



Fig 7 Low power of non tuberculous area with pseudo xanthoma cells Case 6 Chart No 1968



Fig 8 High power of non tuberculous area with pseudo xanthoma cells often mistaken for tuberculous Case 6 Chart No 1968

CASE 5 Mrs C L No 4717 aged 51 years married was admitted to the hospital May 17 1928 and discharged June 4 1928. She entered the hospital with a diagnosis of tuberculosis of the right breast. Her chief complaint consisted of pain in the left shoulder and a small hard nodular lump in the right breast. The history dates back to 4 months ago when she suffered from a rather severe attack of the gripe following which she developed a rather severe pain poorly localized in the left shoulder. She had been treated by diathermy and local applications with no relief. During an examination 7 weeks ago a small painless mass was found in the upper outer quadrant of the right breast. She has been suffering from a mild diabetes for a number of years.

The physical examination including X ray of the chest was completely negative except for the local condition of the right breast. The pain in the shoulder was attributed to a neuritis following an acute respiratory infection. The mass in the breast was the size of a walnut not attached to the overlying skin and only slightly sensitive. The breast was incised and the cystic mass was enucleated. Microscopic examination showed nodular tuberculous mastitis.

CASE 6 Mr E D E male No 1968 aged 30 years married was admitted to the hospital August 3 1917 and discharged August 25 1927. Admission diagnosis was adenoma of the mammary gland. His chief complaint was the presence of a tumor in the right breast for 2 months and a discharging nipple for 2 years. Since the patient could remember he had been accustomed to pinch both his nipples for a peculiar twang which they gave him. The nipple gradually enlarged and 2 years ago began to

discharge a milky white and sometimes bloody fluid on pressure of the breast. Quite accidentally he noticed a small lump underneath this nipple 2 months ago. It had gradually increased in size but there had been no redness or pain. A thick whitish fluid could be expressed from the nipple. There were no other symptoms. His general health was good. Physical examination disclosed a well nourished young man not acutely ill. Complete examination was entirely negative except for the local condition of the right breast and hypertrophy of the nipple of the left breast. He also had a right inguinal hernia. Both nipples were very much hypertrophied. Underneath the right areola there was a hard non tender mass movable over the deeper structures and partially attached to the overlying skin and areola. It was about 2.5 centimeters in diameter and on pressure a small amount of thick whitish material could be expressed. The tip of the nipple was eczematous. The axillary glands were not palpable.

The pre operative diagnosis was chronic mastitis.

The operation consisted of an elliptical incision around the areola down to the muscle with excision of the tumor mass. It was non adherent and was easily dissected away intact. The skin was closed with interrupted silk.

The pathological report at that time was that of chronic mastitis with abscess formation. On reviewing the slides on breast tumors I found that it was a typical case of tuberculosis of the nodular type and with distinct tubercle formations and central caseation.

In conclusion I wish to thank Dr A Eisenberg director who so kindly furnished me with the available material at the Sydenham Hospital.

Bibliography and table with cases from the literature will be published in full in the reprint

CYSTIC DEVELOPMENT IN THE SEMILUNAR CARTILAGES

E S J KING MD MS FRCS MELBOURNE AUSTRALIA

St w Le ur P th l gy U ty f M l bo m

THE development of cysts in the semilunar cartilages of the knee joint was described in 1904 (2) but only during the last decade has it been appreciated as a not very uncommon clinical condition. A considerable number of cases have been reported either singly or in groups and now are within the experience of most surgeons.

The clinical characteristics are well defined but there has been no unanimity of opinion concerning the nature or origin of the cysts. Since some of the features of their development appear to have been overlooked and because some of the observations have been too casual or have been misinterpreted this note is submitted.

Cysts of the semilunar cartilages occur much more commonly in males than in females are more commonly associated with the external than the internal meniscus and have been found slightly more frequently in the left than in the right knee. The condition may be bilateral (personal observation).

The age of the patient is not related to the onset of the condition since it may be found

in young children or old men. Trauma of a more or less definite character is found in the history of the majority of the cases. After the onset of the condition the cysts rapidly progress until they reach a certain size when they become stationary. Osteo arthritis in the same joint may be an associated lesion but apparently is independent.

Surgical treatment consisting of removal of the cysts and the cartilage results in cure.

After removal the cysts are found in the tissue on the outer aspect of the cartilages. Of course on account of their position actual cysts cannot be found clinically in the cartilages but sometimes spaces may be found in them which communicate with the cysts proper. The cysts which are multiple vary from minute spaces just visible to the naked eye to those measuring half an inch or more in diameter.

Microscopically the cyst walls are composed of fibrous connective tissue or fibro cartilage and are lined with a tissue containing elongate cells which have been described



F 1

F 2

F 3

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(e t rnal) X
F g Ph t m u graph f port on f th w l l f e
cyst Th l g fib co ect t th ll

b g mbedd d th d t l y g th r f e X 36
F g 3 A ea f m co d d g t cc g m
th t t th t bo de f m l ca t l g A
f w l l s m y b th t (S F g 4 d 5)
X 3



Fig 4



Fig 5

Fig 4 High power view of the tissue shown in figure 3. The tissue is of the mucoid type and contains large cells. $\times 155$

Fig 5 High power photomicrograph of the tissue and one of the cells shown in Figure 4. The cell shows no sign

of degeneration. The cell outline is well marked and the nucleus is well formed. There are droplets of fluid material in the protoplasm. $\times 25$

Fig 6 Photomicrograph of another portion showing a mucoid area and commencing cyst formation. $\times 155$

variously as connective tissue and as endothelium

HYPOTHESES OF ORIGIN

The principle hypotheses put forward are

- 1 Congenital origin (Ollerenshaw)
- 2 Lymphatic origin (Kleinberg)
- 3 Degeneration of cartilage (Allison and O'Connor)

4 Cysts are analogous with ganglia (Ebner Schmidt)

These hypotheses fall naturally into 2 groups. Hypotheses 1 and 2 rest on the assumption that the cells lining the cysts are endothelial in nature. 3 and 4 depend upon the connective tissue nature of the lining of the cysts.



Fig 7



Fig 8



Fig 9

Fig 7 A mucoid area in the fibrocartilaginous tissue showing early cyst formation. The cyst is lined with tissue which contains pinhead cells most of which lie in the tissue but a few of which are on the surface. $\times 50$

Fig 8 Photomicrograph of a section which indicates one method of enlargement of the cysts by coalescence of

the adjacent spaces. The broken septum is quite apparent. $\times 50$

Fig 9 Portion of a loculated cyst showing the typical appearance of the wall. In a few places the cells line the surface but in most places they occur only in the deeper layers. $\times 70$



Fig 3

Fig 3 Photomicrograph of the placental interface showing the chorionic plate and fetal membrane. The decidua is visible on the left. Magnification $\times 45$.

Fig 4

Fig 4 Photomicrograph of the chorionic plate showing the fetal membrane and decidua. The decidua is visible on the left. Magnification $\times 55$.

Fig 5

Fig 5 Photomicrograph of the fetal membrane showing the decidua and chorionic plate. The decidua is visible on the left. Magnification $\times 900$.

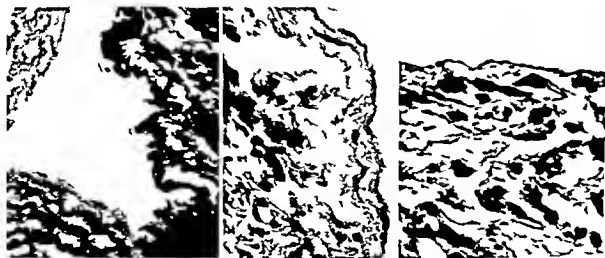


Fig 3

Fig 3 Photomicrograph of the placental interface showing the chorionic plate and fetal membrane. The decidua is visible on the left. Magnification $\times 875$.

Fig 4

Fig 4 Photomicrograph of the chorionic plate showing the fetal membrane and decidua. The decidua is visible on the left. Magnification $\times 5$.

Fig 5

Fig 5 Photomicrograph of the fetal membrane showing the decidua and chorionic plate. The decidua is visible on the left. Magnification $\times 55$.

The determination of the actual type of cell is not difficult since staining by the silver methods allows of a differentiation between

connective tissue and endothelium. Investigation by means of ordinary stains is not conclusive but even judging by the morpho

logical appearances it is apparent that the lining is not endothelium. This will be discussed further.

NATURE OF JOINT TISSUES

Since pathology is abnormal anatomy and physiology it is axiomatic that disease of any portion of the body can be understood only when the normal development, structure and function are elucidated.

The cells of the synovial membrane are modified connective tissue cells which on account of their position have become altered structurally and physiologically.

Synovial membrane is different embryologically from either the endothelium of the coelom or from the endothelium of the lymphatics. Joints arise as a split in an area of 'condensation' of the mesenchyme between developing bones.

Structurally synovial membrane is characteristic. The cells unlike those of endothelium do not usually lie on the surface but are embedded in collagenous tissue and though some may lie close to the surface the majority are situated deeply. In some parts cells lie on the surface in part or a cell process may reach the surface. In other parts some of the cells may lie on the surface completely and resemble endothelium but careful examination will distinguish these since the cells are not in apposition but show fibrous tissue between the cell bodies on the exposed surface.

The cells are spindle long or short or spheroidal in shape. They have deeply staining nuclei and the cells possess large well defined protoplasmic processes. Other features have been discussed in other papers.

Physiologically the synovial surface differs from endothelium. A mucoid material (synovial fluid) is secreted which differs from any material derived from endothelium. The mode of secretion is still undetermined, but droplets may be found in the protoplasm of the synovial membrane cells.

Another though much less significant point is that complete removal of the synovial membrane of a joint is followed by complete restoration of the synovial membrane after a few weeks. This suggests that the membrane is merely modified connective tissue.

Since the tissue lining joint cavities is a specialized connective tissue and not endothelium it might be expected that lesions occurring in synovial membrane would show special modifications of this connective tissue rather than the development of cells occurring, as far as this region is concerned only in lymphatic and blood vessels.

MICROSCOPIC APPEARANCES OF THE CYSTS

The sections of the specimens were examined following staining by haematoxylin and eosin, haematoxylin and Van Gieson and several modifications of the silver impregnation methods. Various appearances were encountered which were interpreted as being different stages in the same process. These will be described in order of development.

Areas of varying though usually small size in which the tissue was homogeneous with but few fibrous strands were found throughout the sections (Fig. 3). Very few cells were present in this material (Fig. 4). These were large spheroidal with well formed nuclei and contained fluid droplets (Fig. 5). The material stained like mucoid tissue, the surrounding tissue gradually merged into the mucoid areas.

Cystic spaces were present in some portions of the tissue described (Figs. 6 and 7). These spaces are lined in part by endothelium like cells and in other parts by connective tissue only (Figs. 9, 10 and 11).

All gradations could be observed between these small cysts and the larger cysts which have only connective tissue in the wall.

The larger cysts are lined by connective tissue and not by endothelium. This is apparent not only from the morphology in haematoxylin and eosin sections but also from the sections impregnated by silver (Figs. 12 and 13). In these the surface material is seen in most cases to be the actual fibrous tissue and the cells are embedded in the fibrous tissue stroma (Fig. 15). A few lie on the surface but these do not constitute an endothelium (Fig. 14).

Cysts of varying size were found in close connection with each other and in many cases adjacent cysts had become continuous with each other as shown by the presence of septa (Fig. 8).

In the walls of some of the cysts fibro cartilage was present but the majority showed only fibrous tissue

DISCUSSION

In the original description and discussion of the condition of cystic development in the semilunar cartilages Ebner and Schmidt both considered that this was comparable with the ganglia. The evidence is all in support of this opinion but since other hypotheses have been advanced emphasis of some of the features of these cysts is necessary

The first problem is the nature of the lining of the cysts. The opinion that the cells are endothelial in character is due to a lack of understanding of the morphology of synovial membrane inadequate examinations and the omission of the use of special staining methods. It is a relic of the older views concerning the nature of synovial linings. This is shown by a reference to the current expressions of opinion

Zadek and Jaffe refer to the synovial nature of the lining endothelium—a manifest contradiction in terms. Though some portions of the cysts show cells on the surface many show cells only embedded in the deeper layers and these have not been mentioned or explained by some writers. Those who support the hypothesis of the endothelial nature of the lining have not brought forward the necessary evidence by use of special methods. An examination of the photomicrographs of the sections of these authors indicates that the lining is connective tissue not endothelium (Ollerenshaw, 6). Since the lining is connective tissue we may discard the hypothesis that the cysts are of lymphatic nature or origin.

Ollerenshaw has put forward certain statements in support of the view that the cysts are of congenital nature. None of these is proof against critical examination and in fact the multiplicity of the cysts suggests an acquired rather than a congenital origin particularly since all gradations may be found between mucoid tissue without cyst formation and well defined cysts.

The history of trauma in so many cases also supports the view that the cysts are an acquired condition.

The remaining hypotheses (1) that of

degeneration in cartilage and (2) that the cysts are comparable with ganglia are similar. In the first place synovial membrane and the cartilage of joints are similar and closely related tissues. They merge into each other and arise from the same original tissue in the embryo—their morphology being governed by the particular part they play in the joint economy. It is to be expected thus that similar changes would occur in both synovial membrane and fibrocartilage.

The reasons for concluding that the changes are degenerative in nature are (a) that thickened blood vessels are found in the cystic area and (b) that the earlier changes found are mucoid degeneration in the connective tissue. On the other hand vessels of the thickness of those seen in sections of these cysts are found usually in the majority of the affections of synovial membrane so that they are probably not primary. The areas of mucoid degeneration are probably not degenerative since the cells present in these areas are well formed in fact larger than the other cells of the part and have a well formed nucleus. The protoplasm contains many well marked droplets.

Since similar droplets are present in the cells of synovial membrane and are probably secretory in nature it is probable that the mucoid areas are the result of secretion of certain of the cells. Examination of examples of ganglion have led me to the conclusion that the process here is also a secretion of the cells rather than degenerative. In this way the cystic change in the semilunar cartilages is strictly comparable with the change associated with the formation of ganglia. It should be stated here that a differentiation is made between degeneration and an exaggeration of normal secretion since both the morphological characteristics of the cells and the restoration to their original state indicate that the condition conforms rather to the concept of an exaggeration of a normal process than to a true degeneration.

In resume the changes present are as follows (1) certain cells enlarge and secrete mucoid material into the connective tissue between them (2) some of this material becomes more fluid and cysts form (3) these gradually

enlarge and the cells in the neighborhood revert to their original spindle form some lying on the surface but the majority being embedded in the tissue Briefly the tissue under some stimulus forms a 'joint cavity' which is comparable with a bursa or ganglion

SUMMARY

- 1 The development of cysts in semilunar cartilages is described
- 2 The lining of the walls is the same as the lining of the synovial membrane a modified connective tissue and not endothelium
- 3 The cysts are comparable with ganglia
- 4 The various hypotheses of their origin are discussed

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THE EFFECTS OF TOTAL GASTRECTOMY

EXPERIMENTAL ACHYLIA GASTRICA IN DOGS WITH THE OCCURRENCE OF A SPONTANEOUS ANEMIA AND ANEMIA OF PREGNANCY

A C IVY Ph D M D J E MORGAN M S AND J I FARRELL Ph D M D CHICAGO
F mth D p m t f Phys i gy d Pharma l gy N tw te U ty M d IS hool

IN this paper we desire to report our observations extending over a period of 7 years on the effects of total gastrectomy in the dog

We have made observations on 14 gastrectomized dogs which have survived 6 months or longer and on the same number that have succumbed to distemper enteritis etc within 1 to 6 months following the operation Of the 14 dogs surviving longer than 6 months we have 7 in the laboratory now with the following postoperative survival periods Dog 3 (Ajax) 6 years 2 months Dog 10 5 years 3 months Dog 11 2 years Dog 13 1 year 9 months Dog 16 1 year 11 months Dog 26 6 months Dog 27 6 months Another dog is on hand which has survived 3 months

This work was started by one of us (Ivy) in collaboration with Drs Lim and McCarthy (37 38) primarily for the purpose of studying gastric secretion For this work dogs with a

'pouch of the entire stomach and a duodeno oesophageal end to end anastomosis were desired and since we have been primarily interested in the question of the mechanism of gastric secretion most of our dogs have had pouches of the entire stomach (37 38) However in 3 of our animals now living (Dogs 10 11 13) the stomach was entirely removed from the body which is an easier operation than to make a pouch of the entire stomach Either procedure obviously deprives the animal of the digestive functions of the stomach and produces a sudden absolute achylia gastrica since in either case the food swallowed passes directly from the oesophagus into the duodenum

The technique of the operation will be described only briefly The operation is performed in one stage We have tried a two stage operation but adhesions caused too much trouble The pylorus is separated from

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A C IVY Ph D M D J E MORGAN M S AND J I FARRELL Ph D M D CHICAGO
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The technique of the operation will be described only briefly The operation is performed in one stage We have tried a two stage operation but adhesions caused too much trouble The pylorus is separated from

the duodenum the duodenum is closed the clamp remaining in place on the pylorus. The duodenum is closed because experience has taught us that it is better to suture the end of the œsophagus to the side of the duodenum than to perform an end to end anastomosis. The œsophagus is pulled down by traction on the stomach and a tunnel is prepared with the index fingers posterior to the cardiac orifice to receive one blade of the clamp. The diaphragm is pushed upward (sometimes it is necessary to cut the reflected diaphragmatic peritoneum at this point) and a special clamp serving to close the œsophagus and to elevate it forward is placed on the œsophagus about $\frac{1}{2}$ to $\frac{3}{4}$ inch above the gastro œsophageal venous ring. A second clamp is placed on the stomach just below the venous ring. The œsophagus is sectioned about $\frac{1}{4}$ to $\frac{3}{8}$ inch above the venous ring. It is not difficult at this point to observe if the section has been made through the œsophagus or the stomach. At this time the cardia of the stomach is closed if a pouch of the entire stomach is to be made. This is not done if the stomach is to be removed. The duodenum is then brought up to the end of the œsophagus and the œsophagus is anastomosed end to side to the duodenum about 1 or 2 inches below the opening of the common bile duct.

Care must be exercised in making the anastomosis so that the duodenum is not kinked so that it is free and movable and is not pressed on by the lesser omentum. If the fibrous portion of the diaphragm is injured too much or if stitches must be taken to prevent pneumothorax the animal is likely to die of pleurisy or mediastinitis the stitches generally pulling out. Postoperative pneumonia frequently occurs. Peritonitis occurs infrequently if the œsophagus can be exposed sufficiently to get a clamp on it which cannot always be done in the dog and if the dogs have been fed meat and milk for several days and then fasted 24 hours to insure a clean stomach. This is done on the hypothesis which has been borne out by our experience with other operative procedures on the stomach that high gastric acidity attenuates virulent organisms (1, 2). This suggests that achylc patients should have their stomachs

laved with 0.3 per cent hydrochloric acid prior to operation unless gastric hemorrhage is known to be present. The day after the operation 400 or 500 cubic centimeters of Ringer's solution are given subcutaneously on the second day small quantities (10 to 25 cubic centimeters) of warm water by mouth at intervals and on the third day small quantities of milk at intervals. After this preliminary period cooked ground meat and bread are gradually added. Our mortality has varied from one period to another. In the first period in which an end to end anastomosis was done 10 dogs were operated upon the mortality was 40 per cent from all causes taking one month as the survival time. When we changed to the end to side anastomosis (Morgan and Ivy) we operated upon 7 dogs with 2 deaths 1 death from peritonitis the other from cachexia. Of these 5 dogs surviving the immediate effects of the operation only 1 is now alive at 2 years the others dying of the following causes: 2 of intestinal obstruction due to adhesions 1 of enteritis and the other was accidentally killed with tetraiodophenolphthalein. Mr Morgan then operated upon 5 dogs and 2 are now alive longer than 2 months. Of all dogs operated by our group 46 per cent have survived 1 month and 23 per cent 6 months.

Diet. The dogs are fed daily a mixture of ground meat (1 pound) which has been brought to the boiling point whole milk (300 to 400 cubic centimeters) and baker's bread ($\frac{1}{2}$ pound) a diet which we know maintains normal dogs in cages for a period of as long as 6 years in a good state of health. The gastrectomized dogs must be fed about twice the maintenance diet required by a normal dog because of the considerable amount of undigested residue passed in the feces. In 3 dogs which we have observed raw ground meat ($\frac{1}{2}$ pound forced fed) passed through the intestinal tract in from 2 to 4 hours practically without being changed in color. When the meat is brought to a boil these irritant properties are lost for the most part.

Eating habits. After gastrectomy the eating habits of the dog are immediately changed. Instead of bolting the food it is eaten slowly and the daily ration is consumed in from 4 to 12

hours Even milk is ingested slowly This change has occurred in every dog in our series As time passes however they eat somewhat more quickly but our 6 year dog still takes 10 or 12 hours and our 5 year dog 4 to 6 hours to ingest the daily ration We believe that the slow eating is due to uncomfortable sensations coming from the duodenum produced by over distention

Compensatory dilatation of the duodenum and œsophagus Obviously one might expect some compensatory dilatation of the œsophagus and duodenum especially since Fauley Strauss, and Ivy have found recently in dogs that if one half to three quarters of the stomach is removed compensatory hypertrophy results in about 6 months in most dogs to the extent that the stomach returns to normal or greater than normal capacity X ray evidence in our gastrectomized dogs shows that only a slight dilatation of both duodenum and œsophagus results

Ulcers Ulcers of the duodenum have not occurred in any of our dogs which shows that the undigested food we feed and as ingested does not cause ulcers and that food of the type and consistency ingested in our dogs *per se* is not a likely cause of postoperative jejunal ulcers in man Recent work on dogs by Fauley Strauss and Ivy shows that postoperative jejunal ulcers following subtotal gastrectomy do not occur until the stomach has undergone hypertrophy and free acidity has returned Neither have ulcers occurred in the pouch of the entire stomach as has been reported by Moutier

Vomiting Gastrectomized animals with both gastric vagi cut but with the thoraco-cœliac branch of the vagus intact vomit when the duodenum is irritated However vomiting is very difficult and prolonged in these animals Food particles from the intestine rarely appear in the vomitus Much bile is present and much air is swallowed and the vomiting and swallowing movements churn the duodenal secretions and saliva into a heavy dense froth On one occasion during an attack of vomiting the intestine was markedly distended with swallowed air so that the abdomen presented the appearance of paralytic ileus It was possible by exerting pressure on

the abdominal wall to expel large quantities of air by mouth An abdominal binder was applied and gaseous distention was prevented

Enteritis Enteritis has been a frequent cause of death in our dogs even among those that survived a period of 6 months It occurs chiefly during the warm months For example 4 dogs were operated upon in November and December Normal weight and health were maintained until the latter part of June when a period of hot weather occurred Then diarrhoea developed and all 4 died within 2 weeks of enteritis Two other gastrectomized dogs that had been operated upon several years before and other dogs in the kennel were unaffected Our explanation of the occurrence of enteritis in these animals is that the attenuating and bactericidal action of gastric juice on ingested organisms was absent and that the hot weather permitted the food in the pans to become heavily infected This explanation is supported by the work of Arnold and Brody on the effect of gastric secretion on the flora of the intestine in that they showed that a preponderance of acid or acidbuffered substances in the upper gastrointestinal tract caused an auto disinfection of the exogenous flora and that hot weather which decreases gastric secretion caused a decrease in this auto disinfecting phenomenon Bartle and Harkins have demonstrated that gastric juice has a germicidal value in *in vitro* studies

Teeth All our dogs have manifested a marked tendency toward tartar formation and 4 of the 7 dogs on hand now show early evidences of pyorrhœa in spite of cod liver oil administration The 6 year old gastrectomized dog whose actual age is approximately 7½ years about 4 years after the operation began losing his teeth only his molars and one canine being intact at the present time On removal of the tartar deposition reappears within 2 weeks The cause and prevention of the tartar deposition is being investigated in collaboration with Dr Skillen of the Dental School the only warranted preliminary statement being that brushing the teeth daily with a fruit containing citric acid prevents deposition of the tartar It is interesting in this connection that Hobday states that pyorrhœa is very common in house fed dogs whose diet is

free of bones. No other disturbances of bony structure have been observed. Hurst (32) and other (30-54) report that pyorrhea and dental caries are very frequently associated with pernicious anemia and achylia.

Stomatitis glossitis and nervous disturbances. We have examined our dogs for the occurrence of stomatitis glossitis and nervous changes since these conditions are clinically associated with achylia without finding evidence of such disturbances.

Blood chlorides. In the dogs in which the stomach is retained as a pouch of the entire stomach from 200 to 400 cubic centimeters of gastric juice is lost daily. This loss of gastric juice obviously might decrease the blood chlorides. An examination of the blood chlorides in these dogs reveals that there occurs a preliminary drop after the operation which returns to normal in about 2 weeks. The preliminary drop is due to the postoperative hypersecretion that occurs in these animals which is also known to occur following the production of a Heidenhain and Pavlov pouch and to the reduced postoperative intake of chlorides in the food. From 7 to 10 days after the operation the animal is on a full diet in which the chloride intake balances the chloride output which accounts for the maintenance of a normal blood chloride level.

ANEMIA

The most interesting and significant finding in these dogs is the occasional development of anemia. The anemia has occurred spontaneously in 3 of the 14 dogs and only during pregnancy in 3 others. Six of the 14 dogs have developed an anemia. Of the 6 that developed anemia 5 had pouches of the entire stomach and 1 had the stomach removed from the body. The 3 dogs that developed the spontaneous anemia were males. The anemia appeared from 6 to 8 months after the operation. We shall record our observations on anemia under two topics, namely, the spontaneous anemia and the anemia of pregnancy.

Spontaneous anemia. A spontaneous anemia appeared early in our work on dogs with a pouch of the entire stomach which was begun in January 1924 in collaboration with Drs. Lim and McCarthy.

The first dog (Dog 1) to develop an anemia was operated upon in February 1924. Eight months later it developed an anorexia, loss of weight and on a study of the blood manifested an anemia. The red cell count was 5.6 million, the leucocytes 18,000 and the hemoglobin 60 per cent. Two weeks later the dog died. The blood finding several days prior to death were: red cells 3,250,000, leucocytes 12,000, hemoglobin 40 per cent. Autopsy revealed no worms and no cause of death other than anemia and cachexia.

A second dog (Dog 2) was operated upon August 19, 1924. This animal returned to good health which was maintained until February 1925. On February 25 the red cells were 6.0 million, leucocytes 11,630, hemoglobin 45 per cent. On March 5 the red cells were 3.3 million and the hemoglobin 30 per cent. In this animal therapy was instituted which consisted of iron and cod liver oil by mouth, ultra violet light and raw and boiled liver by forced feeding. The animal died March 14, very anemic and cachectic. Autopsy revealed no worms nor additional cause of death.

The third dog (Dog 3, Ajax) was observed very closely for the purpose of detecting the onset of anemia and starting therapeutic measures early. He was operated upon November 25, 1924 (weight 17.0 kilograms). Four months later the development of anemia was detected. The red cells were 6.5 million and the hemoglobin 72 per cent. One month later the red cells were 5.2 million, whites 22,000 (normal) and the hemoglobin 52 per cent. Iron carbonate 15 grains daily by mouth had no effect. After 2 weeks cod liver oil was given by mouth and ferric citrate (ampoule 1/2 grains) subcutaneously every other day. The animal improved in appetite and weight and 2 weeks later the red cells were 7.2 million and the hemoglobin 60 per cent. The therapy was stopped and milk buffered with hydrochloric acid was given without preventing the return of the anemia during a period of 8 weeks. Liver (1 pound) was then added to the diet. Since it was found that raw liver caused diarrhea in the second dog, the liver was brought to a boil. The dog ate the liver but it tended to cause diarrhea and by July 20 the dog's weight had fallen to 15.7 kilograms. The red cell count was 4.8 million and the hemoglobin 50 per cent. The dog was then placed on cod liver oil by mouth and iron subcutaneously. His weight had returned to normal by September 1. The red cell count and hemoglobin were practically normal. On September 24, with the animal in perfect condition and the body weight 19 kilograms, the iron was discontinued but the cod liver oil was continued. One month later the red cell count was 4.3 million and the hemoglobin 58 per cent. Four weeks later, November 30, the hemoglobin had fallen to 50 per cent. Iron citrate was then given and the blood returned to normal in 1 month. This dog has been rendered anemic on five different occasions and each time it was found that both cod liver oil *per os* and iron subcutaneously were necessary to

control the anæmia. Ferric citrate $1\frac{1}{2}$ grains once a week was sufficient to hold the hæmoglobin at a normal level. In November 1929 the dog was taken off the cod liver oil and iron with the result that anæmia appeared. Then liver extract¹ one ampoule (4 grams) was given daily for 1 week. The anæmia disappeared and oddly enough has not recurred for over 1 year even though the dog has received no cod liver oil and iron. We can offer no explanation for this fact. (It should be pointed out that blood examinations were made much more frequently than shown in these protocols.)

In Dog 3 which we have observed now for over 6 years the color index during the early periods of anæmia was less than one. As the anæmia developed the hæmoglobin fell first. However after the first 2 years this was not the case, the anæmia appearing and persisting with a color index of 1.0 or slightly above 1. The leucocyte count was uniformly low (15,000 when not anæmic 22,000). During the anæmia the blood smears were approximately as follows: definite anisocytosis, no poikilocytosis, no normoblasts, polymorphonuclears 60 to 70 per cent, small lymphocytes 5 to 8 per cent, large lymphocytes 8 to 11 per cent, eosinophilic polymorphonuclears 3 to 11 per cent, monocytes 3 to 10 per cent, meta myelocytes 2 to 5 per cent, an occasional myelocyte. Blood smears were shown to Professor Maximow who verified our interpretation that the smears showed definite evidence of mild bone marrow stimulation.

Although we have observed our dogs closely we have been unable to detect any cause of the spontaneous anæmia such as infection, worms and diarrhoea. We know that diarrhoea is a contributing and an aggravating cause but we have observed anæmia in Dog 3 in the absence of diarrhoea. We believe that the anæmia is secondary in type and the opinion is supported by the fact that the anæmia is controlled by cod liver oil and iron. Blood volumes were not followed but we shall do so in our future work.

The removal of the stomach in the presence of pre-existing anæmia does not prevent but does retard the return of the blood to normal. Dog 11 of our series was kept anæmic for 1 year by the Whipple method of bleeding and feeding a low hæmoglobin building diet. The stomach then was removed and in 3 months the blood was normal on our regular diet. These dogs generally return to normal in 1 month.

Anæmia of pregnancy. In our gastrectomized colony of 8 dogs we have 4 females

Three of them have become pregnant. Dog 11, three times. Dog 26 once and Dog 27 once. An anæmia has been caused by the pregnancy each time.

Dog 11 was operated upon February 20, 1929. The stomach and spleen were removed from the body. A spontaneous anæmia did not occur in 3 months (Red cells 6.6 million, hæmoglobin 98 per cent). The dog copulated and conceived. At 6 weeks she aborted with red cells 3.2 million, hæmoglobin 56 per cent. She slowly recovered without treatment and 6 months later her red cells were 6.1 million and hæmoglobin 104 per cent. She copulated and conceived again March 26, 1930. Anæmia was detected in 4 weeks. She aborted dead fetuses at 7 weeks with red cells 4.4 million and hæmoglobin 56 per cent and color index 0.7. In 2 months (without treatment) the red cells had returned to normal but the hæmoglobin had not. At 3 months the red cells and hæmoglobin were normal. On August 25, 1930 she copulated and conceived a third time. Five weeks later the red cells were 4.4 million and hæmoglobin 68 per cent. Liver extract² 4 grams daily was then given which was continued for 10 days. The red cells rose to 5.2 million, the hæmoglobin fell to 52 per cent. Cod liver oil by mouth (1 ounce) and ferric citrate ($1\frac{1}{2}$ grains) subcutaneously were then given daily. Seven days later eleven pups (1 dead) were delivered (term of pregnancy 60 days). At that time the dogs' red cell count was 6.9 million and the hæmoglobin 56 per cent. The mother was permitted to nurse 7 pups and the cod liver oil and iron therapy was continued. Ten days after parturition the red cells fell to 5.8 million and the hæmoglobin rose to 69 per cent. The therapy was then discontinued and 19 days later (5 pups nursing, 2 having died) the red cells were 5.4 million and the hæmoglobin 54 per cent. Therapy was resumed. Three weeks later the red cells were 6.0 million and the hæmoglobin 64 per cent. The pups were removed and the therapy was continued but at the present time 6 weeks later her red cells are only 4.4 million and hæmoglobin 70 per cent. (We shall now give her liver extract since it appeared above as if liver extract stimulated red cell production but not hæmoglobin.)

Dog 26 was operated upon July 2, 1930 and a pouch of the entire stomach was produced. Two months later (September 2, 1930) the red cells were 6.8 million and the hæmoglobin 102 per cent. She copulated and conceived at this time. Three weeks later the red cells were 5.8 million and hæmoglobin 83 per cent. On the fifty eighth day of pregnancy the red cells were 4.0 million and the hæmoglobin 66 per cent. The next day parturition occurred. Twelve pups were born all dying the following week. One week after parturition the red cell count was 6.6 million and the hæmoglobin 73 per cent. One month later the red cells were 6.7 million and hæmoglobin

81 per cent Three months after parturition (Janu a y 24 1930) the red cell count was 7 r million and hæmoglobin 90 per cent No treatment was given

Dog 27 was operated July 14 1930 and a pouch of the entire stomach was produced Four months later (November 19 1930) w th a red cell count of 7 5 million and a hæmoglobin of 82 per cent the animal copulated and conce ved Six weeks later anæmia was detected the red cells being 5 3 million and hæmoglobin 72 per cent At 7 weeks the red cells were 4 9 million and the hæmo lobin 61 per cent On January 18 60 days after copulation the dog was quite weak but continued to eat normally The blood picture had not changed The term of pregnancy was up Three days later she was very weak but not too weak to stand and eat The next day she could not stand The red cell count was 3 0 million the hæmoglobin 60 per cent and the color index 1 2 The dog being overdue and very weak 200 cubic centimeters of whole blood was transfused and 2 hours later a Porro section was performed The delivered pups were all alive and appeared to be about 1 week premature They could not crawl The following day the red cell count was 4 0 million and the hæmoglobin 78 per cent Dog died March 13 1931 grave anæmia medulla of femur entirely fill d w th red bone marrow Histological findings to be reported elsewhere

Pregnancy has no such effect on normal dogs fed the diet received by our gastrectomized dogs The chief change in the differential leucocyte count is a monocytosis We have made no examinations of the duodenal flora of our animals The stools are negative for parasites¹

These results show conclusively that in the presence of experimental achylia gastrica the additional strain of pregnancy on the organism induces an anæmia that is secondary in type

DISCUSSION

The stomach has been removed completely or almost completely in dogs or cats by a number of investigators (Carvallo and Pachon Monari Grohe Fremont—pouch of the entire stomach—and Dagaew) Czerny and Kaiser had a dog survive five years Carvallo and Pachon's cat and Dagaew's dog were complete gastrectomies while in the others some portion of the stomach remained which pouched into a bag Carrel Meyer and Levene studied the nitrogen metabolism of 2 dogs one being completely gastrectomized

and the other practically so Both animals were killed after 3 months the exact time not being recorded Mann has recently reported briefly on 3 dogs with total gastrectomy which survived 4 years None of these observers has reported the occurrence of anæmia This is not surprising in view of the fact that a spontaneous anæmia has occurred in only 3 of our 14 dogs Further the 3 dogs which have developed spontaneous anæmia had a pouch of the entire stomach and it is possible that the continued drain of gastric juice to the outside was the cause of the anæmia However this possibility does not apply to the anæmia of pregnancy in our dogs since in 1 of the 3 dogs observed the stomach was removed from the body

Leake and Ritchie produced an atrophic gastritis in dogs with sodium fluoride and observed the development of an anæmia within 10 weeks One cannot be certain however that the anæmia was not due to the absorption of the sodium fluoride

Anæmia has been reported to occur after total gastrectomy in man Hurst (33) states that he knows of 5 cases of total gastrectomy that have developed an Addison's anæmia but does not give references As far as we can find he had in mind 3 cases cited him by Dr J R Bell which were operated for cancer in Vienna the case of Moynihan and the case of Hartman (W F Mayo) Moynihan's case is not to be questioned so far as anæmia is concerned His patient died of a grave anæmia 3 years and 8 months after total gastrectomy and autopsy revealed no recurrence of carcinoma Hartman's case lived almost 3 years after operation and presented a picture simulating pernicious anæmia but autopsy was not done Ellis cites a case of gastrectomy for carcinoma which later developed the picture of combined degeneration of the cord and pernicious anæmia but autopsy report is wanting Cohn has reported a case of total gastrectomy removed for carcinoma who 1 year later developed an anæmia which he maintained was not due to the recurrence of the cancer A further report is not available Denny has reported a case of total resection of the stomach for ulcer which 8 years later developed pernicious anæmia Hochrein has

¹W desu to p es, ur th k to D H R F shia k f th D part
m f p th i gy f mak g h ool nu on ur d es

reported 2 cases of subtotal gastric resections 1 for carcinoma which developed typical pernicious anaemia 3 years later and returned to work after receiving liver therapy and a second which developed an anaemia simulating pernicious anaemia 9 years after subtotal gastric resection for ulcer of the stomach and duodenum which improved on liver and iron therapy Scheidel has recently reported an other case of typical pernicious anaemia developing 6 years after extensive gastric resection for ulcer which responded to liver therapy. Such evidence is very interesting but its interpretation is open to question.

Anaemia has also been reported to occur after gastro enterostomy—Campbell and Conybeare Wilcox and Delore. Obviously such cases may be due to a coincidence because of the small number of cases in relation to the large number of gastro enterostomies performed.

The fact that achlorhydria may precede pernicious anaemia by an interval of from 3 months to 25 or more years has been reported by at least 18 authors in the clinical literature. Hurst (34) in 1925 collected 13 cases in 1931 Conner collected 21 and Davis and Vanderhoof recently reported that they were able to collect 32 cases and had 10 cases of their own but do not give their references. We have been able to collect 36 cases from the literature. Faber and Gram 4 cases, Levine and Ladd 3 cases, Wilkinson 2 cases, Bie Cohet and Moravitz C. Hunter (31), F. Weinberg, Sturtevant, Thaysen, Queckenstedt, Naegeli, Schauman 1 case each, Kuttner, Riley, Lichty and Conner 2 cases each and Davis and Vanderhoof 10 cases. Riley in addition to the reported cases made the statement that he had seen others. In a recent review of the hereditary aspect of achlorhydria in pernicious anaemia Conner cites 37 authors reporting on a total of 110 families, most of the reports being made since Hurst emphasized the question in 1922. Conner examined 154 blood relatives of 109 patients having pernicious anaemia and obtained results that confirmed the general belief expressed in the literature, namely that although the results do not prove an hereditary aspect of pernicious anaemia they strongly suggest a familial

tendency to the development of one of its most important features achlorhydria.

The relation of achylia to the etiology of pernicious anaemia has been particularly emphasized by the recent work of Castle who has demonstrated that if meat is permitted to digest in the stomach of a normal person and is then introduced into the stomach of a pernicious anaemia patient the blood picture is improved. One of us (Ivy 36) has pointed out that gastric digestion increases the secretagogue value of food and that there may be a relation between the secretagogue value of a digest and the anti pernicious anaemia factor is strongly suggested by the fact that liver and liver extract have a higher secretagogue value than any other known food material (Ivy and Kim 39).

Many authors have reported on the occurrence of the association of achlorhydria with various forms of secondary anaemia (19, 20). Wits has recently reviewed the literature and has written an extensive article on a condition which he terms simple achlorhydric anaemia. He defines the condition as a form of anaemia which is not uncommon in women and which occurs occasionally in men being most frequent in middle and later life. This anaemia is improved by iron therapy. On the other hand it is well known that secondary anaemia may occur in the presence of normal gastric function.

Three types of anaemia are reported to occur in pregnancy the pernicious type the severe haemolytic type and the so called physiologic anaemia (22, 24, 29, 52, 55).

It is interesting in this connection that the first papers on pernicious anaemia (Channing and Biermers) dealt largely with pregnant cases. In the pernicious and haemolytic types of anaemia of pregnancy achlorhydria is frequently reported however it is not absolute. Unfortunately gastric analysis is rarely recorded. Smith reported 8 cases with achlorhydria. Hoskin and Cadle reported another case. Rowland reported 2 cases but recorded gastric analysis in only 1 which had free acid present. In the studies on the so called physiologic anaemia of pregnancy practically no attention has been given to the stomach. A very recent article by Wills and Mehta contains



Fig. 1. This is a photograph of a dog, 8 weeks after the operation of achlorhydria, showing the results of the operation.

gastric analyses on 50 cases of anemia of pregnancy. Achlorhydria, however, was found in only a small number. From the available literature on the anemia of pregnancy, one is led to conclude that anemia may occur with or without achlorhydria.

As has been pointed out by Sahli and others, it is reasonable to expect that an anemia may develop in the presence of achlorhydria, since iron salts are insoluble in alkaline solution and the secretion of gastric juice maintains a slightly acid reaction in the upper intestine which would favor the solution and absorption of iron. If this possibility is physiologically significant, one should expect very little effect from oral iron therapy in achlorhydria. We failed to find an appreciable effect. In order to obtain an evident effect from iron therapy, we had to give it subcutaneously. Nevertheless, there must exist some absorption of iron in our achylic dogs, since they all do not develop anemia and 1 dog (Dog 10) has maintained a normal hemoglobin value for over 5 years.

Our interpretation of the anemia that developed in our dogs is as follows: The digestion of the gastrectomized animal is subnormal but is adequate under ordinary conditions to insure sufficient digestion and absorption of hemoglobin and red cell building substances. When some extra demand of the body for hemoglobin and red cell building substances occurs, or when some cause enters and reduces the already subnormal state of digestion below that minimally required, anemia results. It is well known that the factor of safety in digestion is large; that total removal of the external

Fig. 2. This is a photograph of a dog, 8 weeks after the operation of achlorhydria, showing the results of the operation.

secretion of the pancreas more than abolishes the factor of safety, that total continued drainage of bile leads to nutritional disturbances and that excision of the major portion of the small intestine does the same thing. The excision of the stomach or achylia just about annuls the factor of safety in digestion, we believe. In our dogs, the addition of the cod liver oil and iron subcutaneously met the extra demand and substituted for the reduced factor of safety. From our observations on pregnant dogs, anemia occurring five times in five pregnancies, pregnancy creates an extraordinary demand for red cell and hemoglobin building substances and places an extra strain on the factor of safety of digestion. Thus we hold that achlorhydria is a predisposing factor in the genesis of anemia (32).

We believe that this explanation is applicable to the clinically observed effects of achlorhydria in man. A patient may have an achlorhydria without anemia because his factor of safety in digestion is adequate and may continue so until some extra demand, strain, or factor enters the picture. This extra demand may be variable, such as a *Bothriocephalus* worm (19, 35), an abnormal duodenal flora with absorption of toxins (12, 19, 34, 41, 60, 65), chronic biliary (40) or pancreatic disease, atrophy of the intestinal mucosa (19), partial chronic intestinal obstruction (19, 47, 59).



Fig 3 This roentgenogram shows the end to end duodeno-esophageal anastomosis of Dog 3 taken 4 years after the operation and now alive more than 6 years. 1 esophagus 2 duodenum. Very slight dilatation of esophagus and duodenum if any is present.

pregnancy etc. This view is compatible with the fact that anemia may occur in the absence of achlorhydria (omitting anemias due to specific dietary deficiency) since the extra demand may outweigh the factor of safety in digestion.

SUMMARY

Gastrectomized dogs when properly fed maintain themselves surprisingly well. A spontaneous secondary anemia has developed in 3 of 14 dogs with absolute achylia gastrica on a diet adequate for normal dogs. Pregnancy



Fig 5 This roentgenogram shows the end to end duodeno-esophageal anastomosis in Dog 11 2 years after operation. 1 esophagus 2 duodenum. No dilatation is present.



Fig 4 This roentgenogram shows the end to side esophagoduodenal anastomosis in Dog 16 2 years after operation. 1 esophagus 2 esophagus just above anastomosis 3 the start or blind end of the duodenum 4 the jejunum. There is no dilatation of the duodenum and very slight if any dilatation of the lower end of the esophagus.

has uniformly induced an anemia (3 times in 1 dog 1 time in each of 2 dogs). The anemia can be controlled by cod liver oil by mouth and iron subcutaneously. We believe that the achlorhydria is a predisposing factor for the development of anemia in that it reduces the factor of safety of digestion. Other observations on the effect of withdrawal of the functions of the stomach are reported.



Fig 6 This roentgenogram shows the end to side esophagoduodenal anastomosis in Dog 27 6 months after it has been operated upon. No dilatation was present at this time.

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THE PEPTIC GENESIS OF GASTRIC AND DUODENAL ULCER

ESPECIALLY IN THE LIGHT OF ULCERS IN MECKEL'S DIVERTICULUM AND THE POSTOPERATIVE ULCERS IN THE JEJUNUM¹

ARVID LINDAU M.D. AND HELGE WULF M.D. SWEDEN

THE research work of recent years has in many respects brought about a fundamental alteration of our views on the pathogenesis of gastric and duodenal ulcer. Thus the old theory put forward by Virchow and further developed in 1926 by Hauser that anatomical changes in the vessels attended by mucosal infarcts are the cause of gastric and duodenal ulcer and as well the hypothesis framed on clinical grounds by von Bergmann in 1913 that the ulcers may be attributed to a neurogenic spasm of the vascular or gastric walls have both been generally rejected.

Broadly speaking it has not been possible by histological examination to disclose evidence of any primary alteration of the vessels nor has it been possible to establish any definite relation between vascular distribution and ulcer location. Moreover the study of the ulcer complex has brought to light a series of facts for which these two vascular theories fail to provide any satisfactory explanation. In seeking for the underlying cause of ulcer it has been ascribed to a great variety of conditions among which might be mentioned bad dietary habits lack of vitamins food idiosyncrasies focal infections of the mouth tonsils and appendix specific streptococci smoking overwork and so on. This obviously shows the need of further investigation in the genesis of ulcer.

ULCER GASTRITIS—ANATOMICAL PICTURE AND ETIOLOGY

Undoubtedly the most important observation made of late years is the regular appearance in ulcer cases of a gastritis like change confined to the pyloric portion of the stomach (Moszkowicz Konjetzny and co workers Buechner and in the Scandinavian countries Wimtrup Nicolaysen Bjarne Dahl Kalma Bohmansson Ringertz). The pioneer work was here performed by Konjetzny and his co laborators who have given an exhaustive

account of the histological aspect have pointed out the constant occurrence (up to 100 per cent) of these gastric changes and have demonstrated a relationship between them and the fully developed ulcer. Hitherto as far as literature shows rather little attention has been paid to these findings in England and the United States.

The histological gastric picture is rather similarly described by all the investigators.

At the pathological institute in Lund Ringertz has made a critical review of the question of the anatomical picture underlying ulcer gastritis. Like other observers he finds these gastric changes constant and localized to the zone of pyloric glands or to the duodenum. In two thirds of the cases the changes are of a chronic type. Hypertrophic hypertrophic atrophic or atrophic mucous membrane changes may be present. There is also a considerable cellular infiltration between the glands and in about 50 per cent of the cases there is a pronounced hyperplasia of the follicular apparatus (so called gastritis follicularis) localized at the pyloric end. In addition to the chronic inflammation a small number of cases have an acute irritation especially striking on account of leucocytic infiltration. Not infrequently this infiltration is confined to the intermediate layer of mucosa on a level with the gland necks, a fact that has been interpreted by Ringertz as indicating that the juvenile cells within this center of proliferation are especially sensitive to the injurious agent. A duodenitis analogous to this is likewise described though the changes here do not for the most part attain the same degree of development as in the pyloric end of the stomach. The difference that



Fig. 1. Schematic diagram of the gland areas (from Buechner). C Cardiac F fundic and P pyloric glands.



Fig. Normal morphology of the stomach and the duodenum. The duodenum is shown in the lower part of the illustration.

appears to exist when a comparison is made between ulcer cases from different clinics manifests itself chiefly in the varying frequency of the acute gastritic changes and erosions. Ringertz considers that these differences are due to variations in the acidity conditions at the different places and that they also depend upon the phase (exacerbation or remission) in which gastrectomy is performed.

In the earliest stage that preceding the formation of erosions Buechner has been able to prove the presence in man of a fibrinoid necrosis which subsequently is digested by the gastric juice leaving scars. In his experiments on animals described later in which he produced ulcers by pouring hydrochloric acid into the stomach and by other means Buechner has encountered the same fibrinoid necrosis in the earliest phase of the lesions.

That these changes in the mucosa are not secondary conditions of irritation in the tissues surrounding the ulcer but primary to or parallel with the initial stage of ulceration is shown by the fact that the gastritis is uniformly pronounced over the entire pyloric end irrespective of the site of the ulcer (e.g. in the duodenum) and by the fact that this type of gastritis (with clinical symptoms of ulcer) also occurs in cases without any ulcer (Konjetzny, Bjarne Dahl).

The question of prime importance is now *What is the etiology of these changes in the*

mucous membrane and how is their development to be conceived?

The Kieler school supplies only a very meager answer to these questions. Konjetzny and his collaborators attribute the changes to an ordinary exogenous gastritis produced by mechanical, chemical or thermal irritants while bacterial etiology is not considered to come into the question. Of special interest is the fact that they totally deny the possibility of the acid gastric juice being the primary causal factor and regard the current designation peptic ulcer as misleading and erroneous.

This view held by the Kieler school obviously possesses several weak points and overlooks too many physiological factors. For instance no explanation is given of the localization of the gastritis to the pyloric end. This ulcer gastritis however presents such distinctive features that it can scarcely be denoted as an ordinary gastritis. Its often extremely chronic course with recurrences not uncommonly appearing for decades argues far more in favor of a deeply rooted constitutional cause which is inherent in the individual himself.

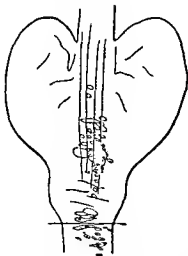


Fig 3 Diagram recording the sites of a large number of gastroduodenal ulcers observed by Orator

All this would tend to show that it is to the biochemical conditions (the acid gastric juice) that we have to look for the primary cause of the typical gastric and duodenal ulcer

This view which was plainly put forward by Guenzburg as far back as 1852 has ever since then played a more or less prominent part in the discussion of ulcer etiology and has found expression in the clinical designation peptic ulcer (Quincke 1879)

After having been eclipsed for a time especially in Germany by Virchow Hauser's and von Bergmann's theories the biochemical view of ulcer genesis has again attracted lively attention Principally because of the work of Buechner and his collaborators in this field a more complete and consistent development of the doctrine postulating the importance of peptic injuries to the mucous membrane has resulted

The aforementioned investigators e.g. Virchow Hauser and von Bergmann also saw in the gastric juice an active factor in the development of ulcers though one that only acted on a membrane which was injured or dead through infarction In like manner the gastric juice had an influence on the maintenance and enlargement of the ulcer The living and uninjured mucosa on the other hand was considered to possess a natural quality which protected it against injury from its own secretion



Fig 4 Chronic gastric ulcer situated in the zone of cardiac gland distinguished by its darker color In addition a pyloric ulcer A Pyloric ulcer B cardiac ulcer

ANATOMY AND PHYSIOLOGY OF THE GASTRAL SYSTEM AND THE POSITION OF ULCERS

Our understanding of the primary injuries to the mucous membranes by the acid gastric juice is due to increased knowledge of the various histologically and biologically heterogeneous zones of glands in the stomach (Oshikawa Moszkowicz Zimmermann Stoehr Orator et al) From the standpoint of anatomy and physiology the upper portion of the duodenum also belongs here and for all these parts of the digestive canal Aschoff has found in the gastral system a suitable term Counting from the oesophagus the following zones come in turn (see Fig 1) (1) The narrow zone of cardiac glands (ordinarily 1.5 centimeters in breadth) (2) the zone of fundus glands (3) the zone of pyloric glands and (4) the duodenal mucous membrane

It is especially to be noted that the zone of pyloric glands on the lesser curvature reaches considerably higher up (above the angulus) than on the greater curvature (see Fig 1) On slitting the stomach along the greater curvature the borderline between the fundus and pyloric gland zones runs as indicated in Figure 2

This transition is not particularly sharp there being a zone a few millimeters in breadth where glands of both types are mixed together

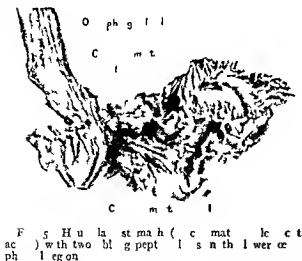


Fig 6 Ulc f Meckel d t c l m (f ma p c m f D Buech C s) i l l u m B call sulce t t d n o d y n t n l m co t the eck f th p uch C Meckel s di et cul m l i d by hyp rpl t c mucosa f fu d c t y p

and which is usually called the intermediate gland zone

The fundus gland area differs from the other portions by the presence of the characteristic glands containing chief and parietal cells and constitutes the sole source for the production of hydrochloric acid and pepsin

No such secretion takes place in the other glandular zones here there is a production of slightly alkaline or neutral mucus. The mucous membrane of the pyloric glands however exercises a regulative action on the production of gastric juice from the fundus. Stimulation is evoked by food while the acid mixed chyme on coming into contact with the mucosa of the pyloric glands has an inhibitory action on this secretion

The central point in Buechner's representation is now that *ulcers arise in the areas of activity of the gastric juice whereas the area of production possesses by nature a relatively high power of resistance*

This receives strong support from the careful record made at various clinics of the position of ulcers in a large number of cases. A good instance of this is afforded by Figure 3 which has been taken from Orator

It is then seen that exceedingly few ulcers are located within the area of the fundus glands these lesions being mostly in the form of radiate scars and not of the callous type while the sites of election are to be found either in the area of the pyloric glands and then especially at the upper angle in the

vicinity of the angulus where the opportunities for acid action are manifestly greatest or in the proximal part of the duodenum particularly close to the pylorus

Occasionally ulcers are encountered in the area of the cardiac glands (in about 5 per cent of the cases) though not marked in Orator's diagram (Fig 3). In the autopsy material of the Institute we have met with ulcers in this region several times. In one case illustrated in Figure 4 we observed that the ulcer was situated in the cardiac area marked off from the surrounding mucosa by its color and showing cardiac glands microscopically

Should the gastric juice have an opportunity of acting upon the mucous membrane of the oesophagus ulcers could also originate there. A predisposing factor is stagnation of the stomach contents e.g. in hour glass stomach. In one of our own cases (Fig 5) it could be seen by fluoroscopy that there was an insufficiency of the cardiac sphincter and that the contents of the stomach perpetually regurgitated up into the lower oesophagus the subsequent autopsy disclosing two oblong ulcers here (as well as an hour glass stomach due to ulcer carcinoma)

Another instance of this law of localization is afforded by the postoperative jejunal ulcers in which the lesion is invariably located within the area of the intestinal mucous membrane and usually close up against the gastroenterostomy (this phase of the subject is discussed more fully elsewhere in this article)

Lastly, in cases of Meckel's diverticulum with a heterotopic gastric mucosa we find in a not inconsiderable number of instances chronic ulcers likewise situated within the area of the intestinal mucous membrane. This interesting chapter will be referred to more fully later on.

THE IMPORTANCE OF AN EXCESS OF ACID GASTRIC JUICE

The feature common to all these cases is the accessibility of the respective areas to the action of hydrochloric acid.

In ulcer disease normal or hypernormal values of hydrochloric acid are found whereas a low acid figure or achlorhydria is rare. Below are given the acid levels found by Kalk at von Bergmann's clinic and by Hurst and Stewart in London hospitals.

| Kalk | Gastric Ulcer | | Duodenal Ulcer | |
|--------------|---------------|---|----------------|---|
| | p | c | p | t |
| Anacidity | 4 | | 0 | |
| Subacidity | 15 | | 0 | |
| Normacidity | 52 | | 25 | |
| Superacidity | 29 | | 75 | |

| Hurst and Stewart | Gastric Ulcer | | Duodenal Ulcer | |
|-------------------|---------------|----|----------------|---|
| | p | nt | pe | t |
| Anacidity | 1 | 9 | 0 | |
| Subacidity | 7 | 6 | 0 | |
| Normacidity | 58 | 4 | 39 | 0 |
| Superacidity | 32 | 1 | 61 | 0 |

To earlier ulcer statistics indicating higher percentages of anacidity cannot be attributed decisive value as they belong to the time preceding the introduction of fractional gastric analysis and of the histamine test. Low acidity after a test meal does not necessarily indicate slow secretion of gastric juice because the acid may be partly neutralized by the alkaline duodenal juices. It should also be remembered that in the case of old ulcers an anacid finding tells us nothing about the acid conditions prevailing at the time the lesion originated. Kalk says: "Es gibt kein frisches Ulcus pepticum in einem anaciden Magenmilieu." It is also an interesting fact that in pernicious anaemia practically all of which patients present a true achylia neither acute nor chronic ulcers have ever been observed as a complication.

Our knowledge of the conditions under which an excess of hydrochloric acid makes itself felt is rather insufficient. A long time

ago Pavlov suggested that the gastric juice as it flows from the gastric glands possesses a constant acidity. Quite recently Hollander and Cowgill have confirmed this by collecting in experimental animals the secretion from isolated gastric pouches without any irritation or contamination. They report that the value of the maximum acidity in hydrogen ion units was 0.91 ± 0.0 (0.55 per cent hydrochloric acid) and that variations in the rate of secretion were not of necessity associated with corresponding changes in acidity.

From this it follows that hypersecretion is brought about not by concentration of the gastric juice but by production of a larger volume of fluid. Accordingly it has been suggested¹ to drop the word hyperacidity from clinical nomenclature.

An excess of hydrochloric acid may be ascribed to three factors: (1) supersecretion, (2) failure of reduction or neutralization of the gastric juice, and (3) lowered resistance of the gastro intestinal wall. These three factors may act alone or side by side in the different cases. Briefly summed up they are:

1. A supersecretion of nervous origin (von Bergmann "Dysharmonien im vegetativen Nervensystem") and not infrequently in connection with psychic influences (Pavlov). The occurrence of ulcers in association with brain affections (Haudeck) or after an operation for cerebellar tumor (Cushing 3 cases) also indicates the possibility of central initiation of increased acid secretion. In these cases however the effect of the additional factor of the stomach being empty must be taken into account.

To this same group belong the cases in which unsuitable food is the cause of supersecretion as in Bergsma's observation. He noticed a very high frequency of gastric and duodenal ulcers among the natives of Abyssinia in contrast to the Negroes in that country. The most obvious difference was in diet. The natives eat daily a dish with a sauce that is approximately 50 per cent cayenne pepper.

2. Unsatisfactory activity of the protective measures at the disposal of the organism against high acid value. Rather little attention has hitherto been paid to this part of the

problem compared with the intense study of supersecretion. According to Kalk, the following processes act as protective measures: (a) The diluent reaction that comes into operation when a certain hydrogen ion concentration is reached; (b) the inhibited production of hydrochloric acid when the stomach is at rest; (c) the production of mucus by the gastric mucous membrane, thus forming a mechanical protection for the mucosa; (d) neutralization through the regurgitation of the alkaline duodenal contents.

One or several of these protective measures might fail and an excess of hydrochloric acid arise.

3. A lowered resistance of the gastrointestinal wall caused perhaps by general disturbances of the circulation (Buechner) or reduced local blood supply (Kalk).

It is evident that these problems derive little or no help from a patho-anatomical investigation of the material. To cover all these functional disturbances in the motility, the secretion and the blood supply of the stomach, von Bergmann has coined the expression *Dysharmonien im vegetativen Nervensystem*.

EXPERIENCE FROM ANIMAL EXPERIMENTATION (BUECHNER)

In their study of the gastric juice as cause of the peptic lesions, Buechner and his co-workers have carried out a series of supplementary experiments under diverse conditions. Only a brief account of these most interesting experiments can be given here; for further particulars the reader is referred to Buechner's exhaustive account.¹

Artificial erosion by hydrochloric acid. By pouring 0.8 to 1.5 per cent hydrochloric acid into the stomach of cats it was possible to produce an erosive gastritis with gross and minute circumscribed defects of the substance. The histological picture accords in all details with that in acute peptic gastroduodenitis.

Histamine ulcers in rats. By hypodermic injections of histamine, which is our most potent pharmacological agent for stimulating the production of gastric juice, it was possible

to cause ulcers in the rumen or oesophageal portion of the stomach of rats. Particularly regular was the appearance of these ulcers in the empty stomachs of fasting animals. These experiments provide a means of accounting for the presence of ulcers in burns, a combination that has long been known (Curling's ulcer), although its pathogenesis has been extremely puzzling. It has been demonstrated (Kaufmann) that histaminoid products are formed in burns. A resulting rise in the hydrochloric acid level in conjunction with an empty stomach obviously furnishes in the light of the experimentally produced histamine ulcers a sufficient explanation of the gastric and duodenal ulcers found in association with injuries from burns.

Operationally produced excess of hydrochloric acid. For some time von Eiselsberg's *Exclusio pylori* was used in the surgical treatment of ulcers. This method, however, was rather quickly abandoned as it developed that peptic jejunal ulcers appeared rather often as a complication according to some investigators in 20 to 30 per cent of the cases. Increased acid production and absence of neutralization by the contents of the duodenum were responsible for this situation. Similarly in surgical experiments on animals, by incapacitating the physiological neutralizing power of the duodenal juices, several investigators have succeeded in producing an excess of hydrochloric acid and constant ulcer formation (Mann and Williamson, Morton and Graham).

Ulcers by sham feeding. By repeating Silbermann's sham feeding experiments on dogs over a considerable time, acute peptic changes with ulcer formation in the stomach and duodenum were obtained. In these experiments too, there is the ulcer-favoring combination of increased acid production and an empty stomach.

In all these experiments the absolute or relative excess of hydrochloric acid constitutes the common factor in the origin of ulcer, a fact that lends weighty support to Buechner's view of the genesis of this disease. To this must be added the fact that the histological picture of these experimental ulcers agrees on all essential points with corresponding acute changes in man.

This view of the action of the gastric juice on the previously discussed portions of the mucous membrane marked by a diffuse gastroduodenitis is apparently in contradiction to the well known experience that the developed ulcers only attain a limited size and are commonly not multiple.

Here a number of factors are at work. The folds of the mucosa obviously cause certain circumscribed areas to be more exposed to the gastric juice with the result that the primary defects will be unequal in size. These multiple erosions however may be reduced and protected by contractions of the muscularis mucosæ and thereby healed. A damaged or perforated muscularis mucosæ is unanimously considered to be of great significance. The protecting contraction does not then supervene and the muscularis mucosæ draws upon the defect instead and enlarges it. A further obstruction to healing is obviously the position of a lesion in the gastric pathway (Magenstrasse) or at narrow passages where functional factors may mechanically contribute to the chronicity of the ulcer (Aschoff). To these must be added the continued action of hydrochloric acid in the base of the ulcer.

The value of the evidence in the ulcer producing experiments described is limited however on account of the fact that the lesions were produced in animals, and under conditions that considerably diverge from the physiological. Of so much greater value on the other hand are some experiences from human material.

EXPERIENCE FROM HUMAN MATERIAL

Under ordinary conditions a typical peptic ulcer never occurs in the intestinal canal below the common outlet of the bile and pancreatic ducts. Only in those cases in which the gastric juice has an opportunity of acting directly upon the mucous membrane of the small bowel does one encounter ulcers of a typical character in that region. Such circumstances exist after a gastroenterostomy when the jejunal mucosa adjoins the gastric mucosa and in certain cases of Meckel's diverticulum when the intestinal mucous membrane is interspersed with heterotopic mucosa of a fundic type.

This latter observation may in fact be regarded as a model experiment of nature¹ demonstrating the pathogenesis of ulcer. It affords one of the best supports for Buchner's view.

ULCER IN MECKEL'S DIVERTICULUM CLINICAL AND ANATOMICAL PICTURE

With reference to ulcer formation in Meckel's diverticulum Konjetzny states: "Dass die Geschwüre in Meckelschen Divertikel ohne weiteres als peptisch bezeichnet werden nur weil im Grunde des Divertikels Magenschleimhaut nachzuweisen ist ist nach meiner Ansicht eine von den vielen unbewiesenen Behauptungen a priori die bei kritischen Betrachtung nicht gerade stichhaltig sich erweisen." Konjetzny thinks that if the dystopic gastric mucosa in the top of the diverticulum really produces any pepsin and hydrochloric acid at all this product would be immediately neutralized by the alkaline intestinal juice.

With reference to Konjetzny's statement and in annotation of some personally observed cases it appears justifiable to give here a somewhat more detailed account of this hitherto rather unnoticed ulcer location² especially as in Buchner's latest publication (1931) only some 15 cases from the literature are reported and it has proved possible to more than double this figure. To save space the cases from the literature are briefly summarized in Table I.

In addition to the cases which are summarized in Table I and in which the presence of gastric mucosa has been verified microscopically there is in the literature another group of similar cases in which the mucosal histology was not investigated. The macroscopic operative or autopsy findings of a typical ulcer however together with the clinical picture (intestinal hemorrhages pains) so completely resemble those of the cases recorded in the table that we can consider them together.

Quot ee thy Harr n B M th ws (P oc Soc Expe Bol & M d 193 xxvii, N 9) has it mpt d to d ph t th tuat sperim tally by n king mail P l po h d causi g t t mpty i to n Isol ted loop flower ileum. I li his 6 dogs larg ul rs (f m t 5 t m ters oss) w f med in the leal m cos d ce t t th gas tri po ch Th (ce wer h type ad f d betw 3, and 30 days. Tw of th d gs ded f pent nitis f mpe f rat n f rs This artl was lmot finish d bef r the il tp per f Aschner d K elutz (Ann. Surg 93 xxi) cam lat our h ds.

CASES OF ULCER IN MECKEL'S DIVERTICULUM WITH MICROSCOPICALLY VERIFIED GASTRIC MUCOSA

| A h Publ | Age | Symptoms | | | Physical | | N t |
|-------------------------------|-------|--|--|---|---|--|--------------------------------------|
| | | P ins | H m h g m | P f t | Loca f f t r | Type f l | |
| Hilg mer 903 (3) | 3 mal | Se er ly ev bd m p espe lly in co ec with m h | R pea d l tes l harm rth ges | — | At th r l d g tr m sa | F d h l to | Op d po W ll |
| D iz 907 (1) | 9 mal | F day g aliz d bd mual pains | A t t l h m h g | S g pe to t | At th k f M k l d cul m | I f ted l | I d d p Ope t d po W ll |
| J H b hma 9 (5) | mal | T ma t bd m | Tw th tes l h mo hag h m m | S gn f p f a m d p to h h bd m t m | At k l M k l d u lum d t th en | P f f d pep l | D d A topy |
| G m 95 (1) | m l | Sl h bd m u l p d g | D g h y ma k d t m | S gn f p f l g hou | A k l M k l d u lum t th as m | I p t l | Ope l po W ll |
| 5 Call d 95 (1) | 9 mos | — | Tw tes l h m h ges w h t ry l f 30 Th last h m b w l th l | — | In l m th b d d d lum | P p ul | D d A topy Sex t d d |
| 6 M l gr ht 95 (38) | mal | F day g used bd m l p ins | Cop harm rth g | — | I M k l d cul m f tes t yp | P u p l l | D d A topy |
| M li 9 (4) | mal | F th day par in th low part f bd m | f m m with bd m l l l bl k tool | S f per tons | A h k l f d t t m d ry m sa | P f d ul | Op d po W ll |
| 8 M li (3) | m l | Symptoms f tes l b tru | — | — | I c y f d d m b luct d M k l d t t m | A tly h d ter w h an t b cul h pec i h ges | Blood d th cys Ope ted po W ll |
| M d d (36) | 9 mal | S f th bee g f m bd m erm bd m t p u to m l to m l | S h first y ev l bl k d bl d l At las h m g late t l h m | — | A d l M k l f d cul m d t to g t m o sa | P p u l | O d po W ll |
| B use 9 (6) | mal | O oc p m h low p t f bdom | T d y later gr es l h m rth ges blark d m | At per es f bl d g w t und s d l f p to en | A k l M k l d u ul m dun ry m sa | P f ted pep l | D d A topy |
| H mbe (6) | mos | F d y bd m l p in v muing | A s d s m th f g t r u n l h mo h ges | S gn f p | N th p f M k l d t lum d t t g d m o sa | p f p d ul | D d A topy |
| Gurb l (1) | mal | Sl gh bd m l ains m w h harm hag | R p ted h mo h ges f ev l two ths | — | A th k f M k l d l m d t ga m o sa | Chr pe tr u g l | Op d po W ll |
| Fas l 5 (5) | f m l | M y yes bd m l p in p u l l associated with d f ulia | On ev f y m bef harm rth ges per um | — | In th mudd f M k l d u lum b al d p e t u | P u l | Op d po W ll |
| Lrh b 95 (5) | 8 mos | — | In es l h m rth g | S gn f p t | I l l m f M k l d cul m | P f d p p t | D d A t p y |
| Ab Str ss (1) | f mal | Abd m u l mp f mo th | I m m w h rth p m bla k tool | — | Nca th pe l M k l d u ul m | I p l l | Op d po W ll |
| B hn 7 (1) | male | — | — | S gn f p to | A th k f M k l d cul m d ry m o sa | Ch pep l | — |
| 7 K l humud Case 96 (3) | 5 mal | Abd m u l pain f y especial y hr after meals | Abd y sev l ex h m o rth g l | S gn f pe | At h bas f M k l d u lum J m | Ch pe t | Ope d p W ll |
| 8 J kso A 97 (5) | 4 mal | Abd m u l cramp l d y | On thard d p ns b gh d tools | — | I Meck l d u lum ad t to tr m o sa | — | Ope d pr W ll |

CASES OF ULCER IN MECKEL'S DIVERTICULUM WITH MICROSCOPICALLY VERIFIED GASTRIC MUCOSA—Continued

| A th P bli tu | Ag S | Symptoms | | | P th l g al ex m u t u | | N t |
|--|------------|--|---|---------------------------------|---|---------------------------------------|--|
| | | P in | Hem h g anam | P f t | Lo t f l | Typ ful er | |
| 9 Tyl 97 (5) | 7 mal | D heta | Th gr t intest l hem rth g th ura l Am | — | I testin l p th hum t h t fun tu w th gastr m | P pt ul Shall w ul h ch er | D d A t poy Th du tucul m t ted in th mes t n wall f th bowl |
| G me 97 (5) | f m l | Slight bd mu l pains | — | Sgn f p t ritomtu | — | P ptu l er | Ope t d p W ll |
| G me 97 (5) | mal | Slight bd mu l pains | — | Sgn f p ritomtu | — | P ptu l er | Ope t d po W ll |
| M C II 97 (35) | 3/ mal | Slight bd mu al p uns | R p t d testi hem h g m th g f am | Sgn f p f t u d pe t ut | In lum d t t th dive tuculum | P f t d ulce | D d A t p y |
| 3 M 98 (37) | — | At 6 mos f g l d bd m l pain Abd m l amp f th last 3 w k | I w th b p in ery bl dy tool ce | — | In M k l du tucul m d t t gastr m | P pt l er | Ope t d po W ll |
| 4 F nk 99 (3) | — | — | — | Sgn f p t nu | I M k l du tucul m I duary m | P ptu l er | D d |
| 5 H tgl sa 98 () | 4 f m l | — | — | Sgn f pent nu | At th b f M k l du tucul m | P f t d) | Ope t d po W ll |
| 6 F t ma d 98 (46) | 6 mal | Abd mu l p | Intestinal hem h g Hem pent eum A znu | Se l d f p f t u | At th b f M k l du tucul m | Chr ul er | Ope t d po W ll |
| 7 T pl 99 (54) | — | Symptom fan pp di t pp d tom bd mu l p ins E | S l gr t test al hem h ges A znu | Sgn f p rit tus | At th k f M k l du tucul m un duary m os | P ptu l er | Ope ted p W ll Gastr ju n d f m fast la |
| 8 W k lb er 99 (58) | 9 mal | Ge he d bd mu l p f som b V muti g | S l gr t test al hem h ges A znu | — | I th bas f W k l du tucul m | P ptu l er | Ope ted po W ll |
| 9 v H b 93 (8) | 3 mal | Abd mu l mp Appe d tomy Pains g | Bl k tool M k d znu | W ll dpe f u | In M k l du tuculum d t t gastr m sa | Ch pept l | Ope ted po W ll |
| 3 v H be 93 (8) | mal | Hes tb f t y ar | On gr t bloody f l | — | Meeck l dive tucul m d t t gastr m sa | P ptu l | Ope t d po W ll I d d t tw pept d d l ul rs |
| 5 S hmidt 93 (5) | 8 mal | — | — | Sgn f p t nu | N th k f M k l du tuculum d t t gastr m osa | () P ptu l (b) P ptu l perf ul | Ope t d po W ll Tw ul rs f und |
| 3 Edwards 93 () | 6 m l | Abd mu l p f ma y y m times t w th m ls | Sev l t tun l hemo h ges A znu | Sgn f p rit tus | N th b f th du tu t m | Perf ted peptu l | Ope t d po W ll |
| 53 A hn and K itz 93 Cas () | 3 f m l | A t d mas th l w bd m | I testinal hem rth g Hemog b ss p t | — | I lum d t uning th gastr m sa th M k l du tuculum | Ch na pe tr ti g ul | Ope t d po W ll |
| 54 A h and Kar liz 93 C () | 6 mal | Abd mu l pain th umbilical ar | Pass d bright d bl dper tum er l times du os hem g l b 3 pe ce t | — | At th k f Meeck l du tuculum t th d t f intestinal and gastr m osa | Peptu l | Ope ted po W ll |
| 35 B hn 93 (7) | 8 f m l | F ev al week bd mu l cramp in m tu with meals v muti g | — | — | I l m t th eck f M k l diverticul m | Chr peptu ulce | Ope ted pon. W ll |
| 3 L d d W lf 93 Case t (Se t) | 5 mal | F sev ly gr p g bd mu l p ns | — | Sgn f perf tu and pe t nu | At th pe f M k l diverticulum unt tu I p th hum l se ganat gastr m sa | P f ted call us ul er | Append tomy D ed. A top y |
| 37 L da Wulf 93 Case t (See text) | 5 f m l | — | Umbil al hem rth ges ry ya | — | In an mb l cal po h partly lined by gastr m osa | Chr peptu l er | Ope t d po W ll |

Such cases have been reported by Denneke (1903) Brentano (1904) Laewen (1909) Griffith (1914) R H Jackson (1924) Stulz and Woringer (1926) 2 cases Abt and Strauss case 2 (1926) Moore (1926) 2 cases Fuss (1926) Kleinschmidt (1926) case

AUTHORS OWN CASES

CASE I Boy of 15 years For several years patient has been troubled at periods with griping pains in the stomach for which he had sometimes been confined to bed on one occas on for 4 days On October 20 19 5 at noon he fell ill with perforation symptoms followed by developing peritonitis Operation was done 3 hours later appendectomy and lavage The appendix was found only secondarily involved in the outer parietal layers (microscopically verified) Patient died after 48 hours of peritonitis

Autopsy revealed a purulent diffuse peritonitis and a Meckel's diverticulum the size of a thumb with well developed mucous membrane which did not exhibit any macroscopically distinct inflammatory irritation At the apex of the diverticulum there was a polypous and fleshy area 2 centimeters in diameter Close against this there was a perforation the size of a pea with even rounded and somewhat discolored margins but without any distinct inflammatory reaction from the surrounding mucosa For the rest the mucous membrane was swollen with prominent follicles though without lesions or exudate

Microscopical examination showed a perforating callous ulcer seated in an essentially unchanged mucosa of intestinal type The polypous circumscribed area of the mucosa had a fundic character but here postmortem changes prevented closer analysis

CASE Girl of 5 years Patient had had a secretory fistula in the umbilical tract since birth Every year there were occasional hemorrhages from this fistula lasting at times half an hour or so She visited a hospital at Angelholm because of increased umbilical hemorrhages Here an omphalic fistula secreting a thin fluid without urinous odor was discovered

Operation including excision of the navel and of a small sac was done The latter which was closed toward the peritoneal cavity was assumed to be the remains of the omphalomesenteric duct Microscopical examination revealed mucosa of fundic character on a small area and adjoining this a chronic ulcer with reaction from the surrounding connective tissue and apparently the source of the bleeding

This case agrees in essentials with that described by P Mueller 1919 (No 8 in the Table) and shows that an ulcer may originate even in a fetal rest of the omphalomesenteric duct without connection with the intestine

As indicated by the tabular cases reported from the literature and by the Lund cases Meckel's diverticulum is not a particularly rare ulcer locality It is remarkable that among the authors cited some have seen repeated cases our countryman K Gramen no fewer than three

Clinical manifestations In contrast to the ordinary gastroduodenal ulcer similar lesions in Meckel's diverticulum appear more especially at early ages The majority appear before puberty and often even within the first year The majority of cases occur in male children as can be seen from the table only a few cases (7) proving an exception to this rule

Three main features characterize the clinical aspect pains intestinal hemorrhages and symptoms of perforation

The pains may at times be entirely absent or of short duration As a rule however the cases show more or less pronounced attacks of pain not infrequently of periodic recurrence at times in association with meals In Cases 9 and 13 in which ulcer in Meckel's diverticulum occurred at adult ages these attacks had an ultrachronic character In other cases pains were a signal of the starting of perforation

Repeated intestinal hemorrhages form the most constant symptom in ulcer located in Meckel's diverticulum Only in a few cases (see table) is this clinical observation missing but then the presence of an anemia can now and then be detected In only one of the recorded cases has hamatemesis occurred which is a natural consequence of the position of the lesion far down in the alimentary tract This position rather far away from the main source of gastric juice also explains why the discharge of bright red blood could be observed in certain cases

Perforation of ulcer in Meckel's diverticulum occurs in about half of the cases is usually preceded by pains and repeated hemorrhages but on occasion there is no noteworthy warning The situation is far more dangerous than in cases of perforated gastric or duodenal ulcers because the contents of the ileum are more infective The regular consequence is a diffuse purulent peritonitis more rarely walling off and resulting in local peritonitis

The diagnosis of an ulcer in Meckel's diverticulum affords great difficulties but with the increased knowledge of this ulcer location is not impossible. This is shown among other things by the fact that some of the authors (Stulz Woringer A Jackson Aschner Karelitz) who observed more than one case were subsequently able to make a correct pre-operative diagnosis.

The differential diagnoses which may be considered as more directly coming into question in the age groups concerned are intussusception and rectal polyps. In intussusception the hemorrhage is as a rule relatively slight and mixed with mucus which in conjunction with possible findings from palpation and X-ray examination usually indicates the diagnosis. In low rectal polyps the hemorrhagic source can often be palpated or detected by proctoscopy.

In cases of Meckel's diverticulum ulcers in which perforation already has occurred operation is as a rule performed on the diagnosis of acute appendicitis. In all acute surgical abdominal conditions in which the findings at operation are not sufficient to account for the symptoms a search should be made for a Meckel's diverticulum. Failure to do this has in several cases as can be gathered from the Table led to a lethal result from continued peritonitis.

Gastrointestinal X-ray examination has been made in some cases without positive findings but may be helpful in excluding a gastroduodenal ulcer as the cause of bleeding.

Pathological anatomy Meckel's diverticulum is as is well known an anomalous remnant of the omphalomesenteric or vitelline duct which is found in 1 to 2 per cent of all autopsies and twice as frequently in males as in females. Various evolutionary degrees of this rest (fistula cyst diverticulum) can be met with from a persistent duct between the intestine and navel to a slight prolapse of a mucous membrane at the umbilicus.¹

In about one sixth of the cases of Meckel's diverticulum the distinctive finding is dystopic mucosa containing chief and acid cells and histologically completely analogous to

the fundic mucosa of the stomach. As yet it has not been possible to discover any satisfactory explanation of this heterotopia but attention may be called to the fact that aberrant pancreatic tissue also occurs in Meckel's diverticulum. The fundic portions may form one or more islets at the apex of the diverticulum or if of large extent may entirely line this pouch.

It is this special category of Meckel's diverticulum that becomes the seat of ulcer formation. The fundamentally important and constantly recurring feature is that this lesion is situated within the area of the ordinary intestinal mucosa (area of activity) and regularly close against the boundary of the dystopic mucosa of fundic type (area of production). From this it follows that cases in which the foreign mucosa only forms one or more islets show the ulcer situated in the diverticulum and usually at its neck. When the entire pouch, however, is lined by gastric mucosa we find the lesion in the ileum close to the neck of Meckel's diverticulum (see Fig 6). Even the macroscopical appearance presents great resemblance to the typical gastric and duodenal ulcers. This resemblance is confirmed by the microscopic picture. The cases reported in the literature as well as our own (in addition examination of two earlier cases Gramen Buechner) regularly present the character of a round ulcer with sharp stamped out margins disrupted muscularis and a callous base. The surrounding mucous membrane may show a very slight chronic irritation with hyperæmia and cellular infiltration under an intact surface epithelium analogous perhaps to an ulcer gastritis but graver inflammatory changes are never seen. Thus these cases do not present any diverticulitis resembling a gangrenous appendicitis with perforation although it is possible for inflammatory changes of the last mentioned nature to occur in Meckel's diverticulum.

That these dystopic portions of mucous membrane in Meckel's diverticulum do not merely resemble fundic mucosa morphologically but are also functionally active has been amply demonstrated by analysis of their secretion in

cases of open umbilical fistula. Both pepsin and hydrochloric acid have been detected by Tillmanns, Lexer, Denue, Rosthorn, Stone, A. L. Taylor. As observed by these investigators, this secretion clearly begins or increases synchronously with the activity of the stomach. This is in accordance with Ivy's experiments on transplanted fundic mucosa in the mammae of dogs, where the transplant was likewise found to secrete gastric juice in connection with feeding. This implies that the production of gastric juice in Meckel's diverticulum occurs at a time during which the small bowel is empty and when no neutralization takes place by food and intestinal juice. In such manner especially favorable conditions are created for the generation of peptic lesions, a circumstance that we find borne out by the occurrence of these ulcers in Meckel's diverticulum even at an early age. This early age incidence affords the only obvious point of difference between the Meckel's diverticulum lesions and the ordinary gastric and duodenal ulcer.

A summary of the facts elicited from the study of ulcers in Meckel's diverticulum brings out the following points against Konjetzny's previously cited view: a production of gastric juice from dysplastic mucosa is proved by the cases of umbilical fistula. This secretion comes into contact with the small intestine when the latter is empty and therefore without any acid neutralizing agent. Both macroscopically and microscopically the lesions present the typical picture of a round ulcer and like this are always located within the area of activity of the hydrochloric acid. Lastly the clinical symptoms presented by ulcer in Meckel's diverticulum, i.e. pains, hemorrhages and perforation, show striking analogy to those in the classical gastric and duodenal ulcer. It may therefore be considered as justifiable also to class the peptic lesions which are encountered in Meckel's diverticulum with the ulcer disease.

POSTOPERATIVE JEJUNAL ULCER

Ulcers of the type dealt with in this article are under ordinary conditions not met with in the jejunum. This is attributed to the fact that the acid gastric juice is neutralized by the

bile and pancreatic juice with the result that peptic ulcers do not occur below Vater's ampulla. An instructive instance of this is Holzweissler's case cited by Hauser. In this patient a woman of 58 years with an obstructed ampulla, eight characteristic erosions and ulcers had developed below the duodenojejunal flexure.

The state of things is quite different if through surgical measures (gastroenterostomy, Billroth II) the jejunal mucosa has been brought in juxtaposition with the gastric for then jejunal ulcers may arise as a not particularly uncommon complication. In about half of the cases the lesions are situated at the anastomosis (gastrojejunal ulcer); the rest lie farther down the jejunum and as a rule in the efferent loop (jejunal ulcer). Histologically they are of the same type as gastric and duodenal ulcers.

Opinions differ as to the mode of origin of these jejunal ulcers. Many authors, especially surgeons, have emphasized mechanical disturbances produced by the operations with interference with the blood supply or irritation from suture material. This does not, however, explain the jejunal ulcers present below the point of anastomosis and there still remains unexplained the fact that postoperative jejunal ulcers occur extremely rarely in cases of gastroenterostomy for cancer of the stomach (with reduced or absent hydrochloric acid).

Closer patho-anatomical inquiry has revealed, however, that postoperative jejunal ulcer arises like other peptic ulcers associated with an inflammatory change in the intestinal mucosa. Even a gross examination is able to show considerable thickening of the wall as well as hyperemia in the efferent loop and at times in the adjacent portion of the afferent loop. On microscopic examination also confirmed by two of our own cases, we encounter the picture of a jejunitis (Heidbreder, Chian, Winkelbauer, Hogenauer), analogous to the corresponding gastric and duodenal changes.

This jejunitis is characterized by great dilatation of vessels, considerable infiltration of cells with eosinophilic leucocytes and plasma cells as well as an increase of connective tissue in the submucosa.

Both Konjetzny and Puhl have described severe jejunitis with scattered erosions in the loop of the gastro enterostomy. Of further interest is the fact that at von Bergmann's clinic it has been possible to establish radiologically the presence of jejunal mucous membrane changes in 100 per cent of the cases of postoperative jejunal ulcer.

In the case of jejunitis too the Krieger school denies that the gastric juice is the primary factor in the generation of these inflammatory changes and condemns the designation peptic jejunal ulcer. However the majority of authors hold to the dominating influence of the gastric juice. A peptic jejunal ulcer is accordingly seen to originate only when hydrochloric acid is left in the stomach after an operation and consequently much oftener after a simple gastro enterostomy than after a resection. We thus meet in analogy to the cases of ulcer in Meckel's diverticulum intestinal mucous membrane directly exposed to the action of hydrochloric acid. This action evidenced by the jejunitis ceases in that portion of the bowel where there is an opportunity for the duodenal juice to neutralize the peptic factor (e.g. at the point of a Braun's anastomosis).

Peptic jejunal ulcer occurs more frequently in males and most often in the young. Perhaps there exist in these cases factors that are more tangibly constitutional expressing themselves for instance in the recurrence again and again of a peptic ulcer despite repeated operations. A particularly instructive case in this respect is that described by G. Petren. This patient underwent 6 laparotomies, 3 of which were for perforation.

CONCLUSIONS

A survey of the experiences acquired will show that in the biochemical theory we have an exceedingly good explanation of the nature as well as the location of the peptic lesions with ulcer formation confined to the oesophagus, cardia, area of pyloric glands, duodenum, jejunum (postoperatively) and in Meckel's diverticulum. Everywhere the lesion is to be found in the area of activity of the hydrochloric acid. The presence of free hydrochloric acid has likewise proved to be

a regular finding and furthermore certain factors that render an excess of the acid possible have been discussed. Buechner's widely laid experiments constitute a powerful support for the trend of opinion here represented.

Our analysis of published cases and of our own cases of ulcer in Meckel's diverticulum has as against Konjetzny's view shown the profound clinical and patho-anatomical accordance of this lesion with the typical gastric and duodenal ulcer.

In Buechner's account the detailed histological description of the most acute changes of fibrinoid necrosis occupies a large space. To this one may perhaps object that even if the presence of this fibrinoid necrosis accords very well with the assumption of an acid effect it would nevertheless be safest to draw no extreme conclusions regarding the etiology of this necrosis on the strength of the histological picture. As a matter of fact the establishment of the position of the lesions and of the occurrence of ulcer in Meckel's diverticulum provides stronger proof of the peptic factor.

This biochemical theory now advanced anew and further developed by Buechner has in fact been taken up and confirmed by several leading investigators.

Aschoff who was able to follow Buechner's researches most intimately associated himself with the peptic point of view in his Nothnagel lecture (published in 1929). In like manner, another pioneer in this field of research, namely Moszkowicz, 1930 declared himself to share the same opinion. Great interest attaches to the fact that in his excellent monograph on 'Magen und Duodenalgeschwuer' Kalk from von Bergmann's clinic expresses the opinion that the gastric juice has again marched to the foreground as a genetic factor of ulcer, contending however, that the excess of hydrochloric acid is due to a

Dysharmonie des vegetativen Nervensystems. Lastly Buechner's view has recently been endorsed also from a surgical source (von Haerer).

With reference to the therapeutic bearing of the view of ulcer genesis maintained in the foregoing the following may be quite generally said. The main object would be to

control and reduce as far as possible the production of hydrochloric acid by suitable dieting in accordance with the experiences gained chiefly through the Pavlov school these experiences having already been applied at many clinics. It will however be necessary to devote greater attention than before to the psychic phase of acid secretion in a fasting stomach. The old clinical observation of the beneficent and healing effect of alkaline treatment more closely worked out by Sippy also receives further support by putting the action of the acid gastric juice in the fore ground.

Considering surgical therapy with its rather varying measures the operation Billroth I which reduces the production of hydrochloric acid removes that part of the gastric system which is most susceptible to ulceration while retaining to the greatest possible extent the normal topography and normal discharging conditions is probably the method that yields the best results and shows extremely few or no cases of relapse or postoperative ulcer (von Haberer Bohmansson).

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THE NATURE OF THE AMNIOTIC FLUID

A COMPARATIVE STUDY OF HUMAN AMNIOTIC FLUID AND MATERNAL SERUM¹ALEXANDER W. MAKEPEACE² M.D. FRANK FREMONT SMITH M.D. MARY ELIZABETH DAILEY, A.B.
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THE source and nature of the amniotic fluid its rate of formation the mode of reabsorption if reabsorption occurs the factors which govern its volume are all matters of conjecture concerning which but little data exist. Even the chemical composition has been studied in detail by only one modern investigator. This interesting and important fluid is not mentioned in most textbooks of physiology and biochemistry.

In this paper we are reporting comparative studies upon the human amniotic fluid and maternal blood in 33 instances and studies upon the amniotic fluid alone in 3 instances.

Our data lend support to the theory that the amniotic fluid is primarily a dialysate of either maternal or fetal blood, diluted to a varying extent by fetal urine.

METHODS

The amniotic fluid was obtained in two ways. One method was to use a large bore needle puncture the unruptured bag of forewaters as it presented at the vulva and draw the fluid into a syringe the other was to expose the unruptured membranes at cesarean section and withdraw the fluid with syringe and needle. Occasionally the amniotic fluid was contaminated with a slight amount of blood. All fluids except those obtained early in pregnancy which were clear were centrifuged to remove the vernix caseosa.

Blood was obtained from an arm vein without stasis and received directly under oil. The blood was centrifuged under oil and the serum pipetted off placed under oil and kept cool until used. In all except 3 cases the amniotic fluid was obtained before the sample of blood. These time relationships and types of an aesthesia and operation are shown in Table V.

Total solids were determined gravimetrically upon 1 or 2 cubic centimeter samples dried to a constant weight between 105 degrees and 110 degrees C. Specific gravity

was done by the drop method of Barbour and Hamilton. The depression of the freezing point was determined with the Beckmann cryoscopic apparatus a Heidenhain thermometer and a mechanical stirring device being used (Findlay). Chlorides were determined either by the method of Van Slyke or by the modification of Wilson and Ball. We obtained identical results by these two methods before adopting the modification. Sodium determinations were done by the Rourke modification of the Kramer and Gittleman method. Calcium was determined by an unpublished method of Fiske. The total nitrogen of the serum was obtained by the Dyer modification of the Kjeldahl method 1 cubic centimeter of serum being used. The total protein of the serum was calculated by subtracting the non-protein nitrogen from the total nitrogen and multiplying by 6.25. The total protein in the amniotic fluid was determined by the method of Denis and Ayer and in 4 instances checked by the macro-Kjeldahl method (Table I). The agreement was very satisfactory. Non-protein nitrogen and creatinine were determined by the method of Folin and Wu. The total reducing substances were determined by the Folin and Wu method using the modified sugar tubes of Rothberg and Evans.

Yeast fermentation was determined by the method described by Benedict. Hydrolysis was done according to the method used by Folin and Berglund.

Osozones of the sugars were formed using a phenyl hydrazine sodium acetate mixture as described by Hawke and Bergeim in their textbook. The protein was removed from the amniotic fluid before the phenyl hydrazine mixture was added by adding a few drops of a 5 per cent solution of acetic acid beating on a water bath for 2 to 3 minutes and then shaking with purified animal charcoal and filtering. Six or 7 cubic centimeters of this filtrate were used for the osazone reaction.

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pressure appreciably by aerating the blood serum with hydrogen. They reasoned that the lower osmotic pressure of the amniotic fluid could be explained only by a dilution with some hypotonic solution. They then presented data on the freezing point of 9 samples of urine of newborn infants—these ranged from -0.148 degrees to -0.340 degrees C with an average value of -0.203 degrees C. The chloride (sodium chloride) contents of these urines ranged from 123 to 403 milligrams per 100 cubic centimeters with an average value of 299 milligrams per 100 cubic centimeters. These urines were all protein free. The urines of four infants 24 hours to 6 days old had freezing points ranging from -0.609 degrees to -1.064 degrees C while the chloride was only moderately increased ranging from 227 to 441 milligrams per 100 cubic centimeters. The increased concentration of urine in the first few days after birth is therefore due chiefly to substances other than chlorides. These are present only in small amounts in fetal urine.

Zangemeister and Meissl calculated that 16.5 per cent of amniotic fluid must be fetal urine to give the amniotic fluid its average concentration. This would mean an average of 81 cubic centimeters of urine (amniotic fluid volume taken as 500 cubic centimeters). As however there must constantly be a tendency for the amniotic fluid to be approaching an equilibrium with the maternal or fetal blood somewhat more than this amount of urine would be required. As the fetus could not form 81 cubic centimeters of urine during labor fetal urine must be forming in the latter portion of pregnancy particularly as in a few instances amniotic fluid obtained before or just at the onset of labor was definitely hypotonic to maternal blood. In one case of abortion at 5 months (fetal length 25 centimeters) the maternal serum had a freezing point of -0.535 degrees C and the amniotic fluid -0.520 degrees C. (This amniotic fluid was coffee brown and contained 0.69 per cent methæmoglohin.) Zangemeister and Meissl concluded that as early as the fifth month of pregnancy the amniotic fluid must be diluted with an appreciable amount of fetal urine.

These data of Zangemeister and Meissl have been given in some detail because it is the most important in the literature and because our own data are closely parallel.

Gruenbaum agrees with Zangemeister and Meissl that the amniotic fluid is hypotonic to maternal serum and quotes several authors to this effect. He emphasizes the fact that Jacque found at 6 months pregnancy the freezing point of the amniotic fluid -0.520 degrees C and that of the fetal blood -0.530 degrees C. Gruenbaum presents data on the amniotic fluid in one case at 8 weeks of pregnancy. Nine cubic centimeters of clear fluid were obtained slightly alkaline to litmus with a dry weight of 1.048 per cent ash 0.606 per cent and freezing point -0.495 degrees C. Unfortunately the maternal blood was not examined. Gruenbaum concludes that in the earlier months of pregnancy there is less difference in freezing point depression between amniotic fluid and maternal blood than at term.

RESULTS

Our data on maternal serum and amniotic fluid in 21 cases at term are shown in Table III and in 15 cases earlier in pregnancy are shown in Table IV.

In general our findings are similar to those reported by Zangemeister and Meissl and by Uyeno. Our values for chloride in the amniotic fluid however are somewhat higher than those reported by these observers. The values of Williams and Barger for chlorides in amniotic fluid are so low averaging 5.93 milligrams per 100 cubic centimeters in normal fluids as to be inexplicable except on the basis of a misprint. As is shown in Table II Zangemeister and Meissl found the chloride value in the amniotic fluid close to but averaging slightly less than that in the maternal serum. In our cases at term (Table III) the average value was definitely higher in the amniotic fluid than in the maternal serum. In 7 cases only was the relation reversed the greatest excess in the serum being 20 milligrams per 100 cubic centimeters (Case 5) while 8 cases showed an excess of chloride in the amniotic fluid of from 30 to 124 milligrams per 100 cubic centimeters. In all of the 12 cases before term (Table IV) the amniotic

TABLE III—AMNIOTIC FLUID AND MATERNAL SERUM AT TERM

| C ₄₂ N | V ₁ Se m gr ^{oo} m | i Am E1 m | | pN mgms / ooc m | | S E mgms ooc m | p ₁ mgms oo | V ₂ mgms / ooc m | Se um Am E1 | mgms / ooc m Am E1 | C 1 mgms Am E1 | C mgms | ooc ctt | pes 6 gr ty | Seru | Am E1 | Se m Am E1 | T al S ₀ d mgms / ooc grm | F res p Am E1 | | M the p sm cy |
|----------------------|---|-----------------|-----------|--------------------|------------|-------------------|------------------------------|--------------------------------|----------------|-----------------------|----------------------|-----------|---------|-------------|------|-------|---------------|--|------------------|-----------------------|------------------|
| | | Am E1 m | Se m m | Am E1 m | Se um m | | | | | | | | | | | | | | Am E1 m | mgms / ooc m Am E1 | |
| | 5.8 | | 0 | 5 | 5 | | 644 | 665 | | | | | | 3 | | oo B | 0 | 3 | 5 6 | N | |
| | 6.6 | 65 | 5 | 7 | | | 5 | 59 | | | | | | 5 | | ooB3 | 6 | 53 | 466 | N | |
| 3 | 6 | 8 | 3 | 5 | 95 | | 6.3 | 6.5 | | | | | | 10 | | oo | 7 85 | 7 | 519 | N | |
| | 5.6 | | | 3 | 06 | | 0.33 | 66 | | | | | | | | oo7 | 7 | 0 | 509 | N | |
| 5 | 6.8 | 3 | 0 | | | | 0.45 | 6.5 | | | | | | 5 | | oo66 | 8 3 | 6 | 563 | N | |
| 6 | 6 | 0 | | 23 | 7 | 8 | 533 | 6.3 | | | | | | oo | | oo73 | 8 3 | 7 | 55 | N | |
| 7 | 6.5 | 5 | 6 | 0 | 5 | 8 | 6.7 | 66 | | | | | | 3 | | ooB5 | 8 5 | 47 | 56 | N | |
| 8 | 6.8 | 5 | | 6 | 4 | 3 | 107 | 559 | | | | | | 3 | | oo6 | 0 37 | | 567 | N | |
| | 6.6 | 8 | 3 | 37 | 5 | | 593 | 518 | | | | | | 57 | | | 8 5 | | 558 | N | |
| | 5.3 | 7 | 6 | 93 | 4 | 6.7 | 6.6 | | | | | | | 5 | | ooB5 | 7 80 | 0 | 538 | N | |
| | 6 | 38 | 5 | 5 | 53 | 8 | 593 | 6 | | | | | | 5 | | oo74 | 8 | 5 5 | 407 | N | |
| | | 0 | | | 51 | | 7 | | | | | | | | | | | | | N | |
| | | 76 | 3 | | 3 | 7 | 106 | 506 | | | | | | 3 | | oo77 | 8 | 4 | | N | |
| 5 | 5.7 | 6 | | 3 | 6 | 9 | 6.4 | 614 | | | | | | 6 | | oo 3 | 8 3 | | 56 | 5 6 | |
| 5 | | 6 | | | 6 | | | | | | | | | | | | | | | | |
| 4 | 6.5 | | | | | | 6 | 58 | 34 | 0 | | | | | | | | | 55 | 488 | |
| 5 | 6.4 | 0 | 3 | | | | 3 | 63 | 85 | 83 | 8.3 | 5.3 | | | | | 6 | 3 | 55 | 4 | |
| 6 | 6.3 | 0 | 3 | 4 | 4 | 58 | 6.7 | 667 | 3 | 3.4 | 8 | 7.3 | | | | | | | 5 3 | 5 | |
| 7 | 5 | 5 | | 7 | 73 | 5 | 6.0 | 6.4 | 5.8 | 88 | | | | | | | 7 0 | 3 | 5 3 | | |
| 8 | 5.5 | 5 | 19 | 3 | 6 | 6.9 | 6.3 | 0 | 73 | | | | | | | | | | 513 | 5 N | |
| 9 | 0.5 | | | 8 | 8 | 6 | 6.05 | 3 | 3 | | | | | | | | | 0 | 5 | 500 N | |
| | | | | | | | 6 | 588 | 3 | 33 | | | | | | | | 8 | 5 0 | | |
| | 6 | 3.4 | 3 | 7 | 79 | 5 | 6.6 | 614 | | | | | | 10 | | oo 7 | 8 87 | 34 | 56 | 5 | |
| 11 h | 6.8 | 5 | | 39 | 53 | 6 | 6.45 | 667 | 34 | 3.4 | | | | 13 | | ooB5 | 4 | | 513 | 54 | |
| Low | 5.3 | 5 | | 8 | 73 | | 8 | 559 | 85 | 73 | | | | oo | | oo6 | 7 0 | | 5 6 | 65 | |
| A | 6 | 3 | 4 | 7 | | | 35 | 6.4 | 6 | 3 | 0 | 8.4 | 6.3 | 7 | | oo73 | 8 37 | | 55 | 5 | |

TABLE IV—AMNIOTIC FLUID AND MATERNAL SERUM BEFORE TERM

| Case N | P t m | | N p N | | S ga | | Chl nd | | S d m | | Cal m | | C u | | Spe n gr ty | | T t l s o l d | | F ang | | M th p g cy |
|-----------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|----------------|
| | S rum gm / cc m | Am Fl mgm / cc m | S rum mgm / cc m | Am Fl mgm / cc m | S rum mgm / cc m | Am Fl mgm / cc m | S rum mgm / cc m | Am Fl mgm / cc m | S rum mgm / cc m | Am Fl mgm / cc m | S rum mgm / cc m | Am Fl mgm / cc m | S rum mgm / cc m | Am Fl mgm / cc m | S rum mgm / cc m | Am Fl mgm / cc m | S rum mgm / cc m | Am Fl mgm / cc m | S rum mgm / cc m | Am Fl mgm / cc m | |
| | 5 | 3 | 3 | 36 | 5 | | 99 | 699 | | | | | | | 0076 | | 7 00 | 9 | 554 | 506 | Eght |
| 3 | 5.5 | 5 | 4 | | | | 3 | 59 | 615 | 3.3 | 3.9 | | | | | | | | | 5 | Eght |
| 4 | 5.7 | 506 | 4 | 8 | 38 | | 6 | 613 | | | | | | | | | | | | | Se |
| 5 | 6 | 999 | 9 | | 88 | 6 | 638 | 696 | | | | | | | | | | | | | Eght |
| 6 | 5.9 | 49 | 34 | 6 | 93 | | 593 | 7.5 | | | | | | | 37 | | 7.7 | 8 | 55 | 5.6 | Se |
| 7 | 5.7 | | 3 | 7 | 5 | 44 | 6 | 64 | 3.3 | 96 | 8.6 | 5.6 | | | 34 | | 7.7 | 1.5 | 557 | 54 | Six |
| 8 | 6.3 | 33 | 4 | | 7 | 64 | 604 | 64 | | | | | | | | | 8.96 | 1.5 | 96 | 5.7 | S |
| 9 | 6 | 57 | 4 | 5 | | 4 | 6.4 | 619 | 306 | 3.3 | | | 39 | 1.43 | | | | | 557 | 537 | F |
| 36 | | 308 | | | | | 60 | 64 | | | | | | | | | | | 539 | 55 | F |
| 3 | 6 | 34 | 7 | 5 | 8 | 44 | 6 | 64 | 300 | 3 | 9.6 | 8.8 | | | | | 8.67 | 7 | 589 | 539 | Th Fur |
| 3 | 6.7 | | 8 | 5 | 4 | 86 | 584 | 6.5 | 3 | 300 | 8.5 | 7.4 | | | | | | | 517 | 562 | Th Fur |
| 3 | | † | | | | | 7 | | 3.6 | | | | | | | | † | | | | |
| 3 | | 00 | 5 | | | 7 | | 64 | | | 8.7 | | | | 008 | | | | | 5.1 | Thr |
| 33 | | 16 | | 35 | | 5 | | 655 | | | | | | | 0086 | | | 36 | | 54 | Three |
| 34 | | 6 | | 34 | | 5 | | 67 | | | | | | | 0077 | | | | | | Two-Thr |
| 35 | 6.6 | 66 | 3 | 8 | | | 588 | 6.5 | | | | | | | 6 | | 7.96 | 1 | 553 | 556 | Tw Three |
| High | 6.7 | 5 | 34 | 36 | 4 | 86 | 638 | 7.5 | 3.3 | 3.9 | | | | | 6 | | 8.96 | 8 | 589 | 56 | |
| Low | 5 | 00 | 7 | 8 | 88 | | 584 | 6.5 | 300 | 96 | | | | | 0076 | | 7.00 | 1.7 | 539 | 5.6 | |
| A | 6 | 378 | 5 | 6 | 8 | 4 | 6.4 | 648 | 3.9 | 3 | 8.9 | 7.3 | 39 | 3 | 0087 | | 8.00 | 39 | 557 | 539 | |

F 8 (th s) ar f m fluid
† p l fluid pr t m m l t P dy test

TABLE V — TIME RELATIONSHIPS AND TYPE OF ANÆSTHESIA

| Case | Interval between maternal blood | Anæsthesia | Comments |
|------|---------------------------------|----------------------------|--------------|
| 1 | 5 mi | N | 5 hours 1 bo |
| 2 | 5 mi | N | 1 hour 1 bo |
| 3 | 5 mi | G-s-o-yg d h | |
| 4 | 5 mi | G-oxyg d th | |
| 5 | 5 mi | G-s-o-yg and ther | |
| 6 | 5 mi | G-s-o-y d th | |
| 7 | 5 mi | G-oxyg d h | |
| 8 | 5 mi | G-oxyg d th | |
| 9 | 5 mi | Sp 1 morph and gas-sy opol | Cesarean |
| 10 | 5 mi | Sp 1 morph 1 sco | Cesarean |
| 11 | 5 mi | Gas-oxy d h | Cesarean |
| 12 | 5 mi | Sp 1 morph d o | Cesarean |
| 13 | 5 mi | Sp 1 | Cesarean |
| 14 | 5 mi | Sp 1 | Cesarean |
| 15 | 5 mi | Sp 1 | Cesarean |
| 16 | 5 mi | G-s-o-yg d th | Cesarean |
| 17 | 5 mi | G-oxyg and h | Cesarean |
| 18 | 5 mi | G-oxyg d h | Cesarean |
| 19 | 5 mi | G-s-o-yg d th | Cesarean |
| 20 | 5 mi | G-s-o-yg d th | Cesarean |
| 21 | 5 mi | G-s-o-yg d th | Cesarean |
| 22 | 5 mi | G-s-o-yg d th | Cesarean |
| 23 | 5 mi | G-s-o-yg d th | Cesarean |
| 24 | 5 mi | G-s-o-yg d th | Cesarean |
| 25 | 5 mi | G-s-o-yg d th | Cesarean |
| 26 | 5 mi | G-s-o-yg d th | Cesarean |
| 27 | 5 mi | G-s-o-yg d th | Cesarean |
| 28 | 5 mi | G-s-o-yg d th | Cesarean |
| 29 | 5 mi | G-s-o-yg d th | Cesarean |
| 30 | 5 mi | G-s-o-yg d th | Cesarean |
| 31 | 5 mi | G-s-o-yg d th | Cesarean |
| 32 | 5 mi | G-s-o-yg d th | Cesarean |
| 33 | 5 mi | G-s-o-yg d th | Cesarean |
| 34 | 5 mi | G-s-o-yg d th | Cesarean |
| 35 | 5 mi | G-s-o-yg d th | Cesarean |
| 36 | 5 mi | G-s-o-yg d th | Cesarean |
| 37 | 5 mi | G-s-o-yg d th | Cesarean |
| 38 | 5 mi | G-s-o-yg d th | Cesarean |
| 39 | 5 mi | G-s-o-yg d th | Cesarean |
| 40 | 5 mi | G-s-o-yg d th | Cesarean |
| 41 | 5 mi | G-s-o-yg d th | Cesarean |
| 42 | 5 mi | G-s-o-yg d th | Cesarean |
| 43 | 5 mi | G-s-o-yg d th | Cesarean |
| 44 | 5 mi | G-s-o-yg d th | Cesarean |
| 45 | 5 mi | G-s-o-yg d th | Cesarean |
| 46 | 5 mi | G-s-o-yg d th | Cesarean |
| 47 | 5 mi | G-s-o-yg d th | Cesarean |
| 48 | 5 mi | G-s-o-yg d th | Cesarean |
| 49 | 5 mi | G-s-o-yg d th | Cesarean |
| 50 | 5 mi | G-s-o-yg d th | Cesarean |
| 51 | 5 mi | G-s-o-yg d th | Cesarean |
| 52 | 5 mi | G-s-o-yg d th | Cesarean |
| 53 | 5 mi | G-s-o-yg d th | Cesarean |
| 54 | 5 mi | G-s-o-yg d th | Cesarean |
| 55 | 5 mi | G-s-o-yg d th | Cesarean |
| 56 | 5 mi | G-s-o-yg d th | Cesarean |
| 57 | 5 mi | G-s-o-yg d th | Cesarean |
| 58 | 5 mi | G-s-o-yg d th | Cesarean |
| 59 | 5 mi | G-s-o-yg d th | Cesarean |
| 60 | 5 mi | G-s-o-yg d th | Cesarean |
| 61 | 5 mi | G-s-o-yg d th | Cesarean |
| 62 | 5 mi | G-s-o-yg d th | Cesarean |
| 63 | 5 mi | G-s-o-yg d th | Cesarean |
| 64 | 5 mi | G-s-o-yg d th | Cesarean |
| 65 | 5 mi | G-s-o-yg d th | Cesarean |
| 66 | 5 mi | G-s-o-yg d th | Cesarean |
| 67 | 5 mi | G-s-o-yg d th | Cesarean |
| 68 | 5 mi | G-s-o-yg d th | Cesarean |
| 69 | 5 mi | G-s-o-yg d th | Cesarean |
| 70 | 5 mi | G-s-o-yg d th | Cesarean |
| 71 | 5 mi | G-s-o-yg d th | Cesarean |
| 72 | 5 mi | G-s-o-yg d th | Cesarean |
| 73 | 5 mi | G-s-o-yg d th | Cesarean |
| 74 | 5 mi | G-s-o-yg d th | Cesarean |
| 75 | 5 mi | G-s-o-yg d th | Cesarean |
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| 99 | 5 mi | G-s-o-yg d th | Cesarean |
| 100 | 5 mi | G-s-o-yg d th | Cesarean |

fluid chloride was definitely higher than that in the maternal serum. In the few cases in which calcium was determined our values are definitely lower than those reported by Uyeno. Uyeno was not able to demonstrate the presence of creatinine or sugars in the amniotic fluid. Williams and Bagen how

ever found creatinine and reducing substances in the amniotic fluid. Here as in the case of chlorides their figures are so bizarre that some error in the position of the decimal point must be assumed. It is therefore futile to compare their figures with ours. In 7 instances we have determined creatinine in maternal blood and amniotic fluid and in every instance the amount in the amniotic fluid exceeded that in the serum (Tables III and IV). As the color produced in the Folin and Wu method is not specific for creatinine and as we have not identified creatinine as such in the amniotic fluid there is no assurance that creatinine was actually present in the amounts indicated. The reducing substances in the amniotic fluid determined by the method of Folin and Wu and calculated as glucose ranged from 11 to 62 with an average of 33 milligrams per 100 cubic centimeters in the cases at term (Table III) while in the cases before term the range was from 11 to 86 with an average of 42 milligrams per 100 cubic centimeters (Table IV). The maternal serum sugar in these two groups of cases averaged 114 to 118 milligrams per 100 cubic centimeters respectively.

The characteristic osazones of glucose and of lactose were formed in the protein free filtrate of several but not all fluids at term while in one case at from 3 to 4 months pregnancy the osazone of glucose but not that of lactose was demonstrated. We have also demonstrated the presence of a fermentable reducing substance presumably glucose in 13 samples of amniotic fluid. The total reducing substances were significantly lowered by yeast fermentation in every case. In 1 case the reducing substances dropped from 58 to 4 milligrams per 100 cubic centimeters after fermentation with yeast. In 8 of these instances mild hydrochloric acid hydrolysis of the protein free filtrate after yeast fermentation produced an increase in the reducing substances in 4 cases at term suggesting the presence of di- or polysaccharides while 3 cases early in pregnancy and 1 at term showed no such increase in reducing substances after hydrolysis. The data are shown in Table VI. They indicate the presence of small amount of glucose in human amniotic fluid and sug

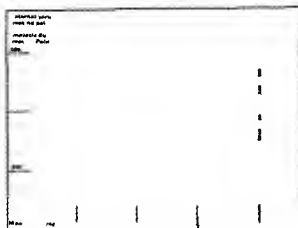


Fig 1 This figure shows the tendency for the amniotic fluid to become more and more hypotonic to the maternal serum as pregnancy advances

should contain and the more nearly isotonic with the blood it should be. Gruenbaum had already suggested that in the earlier months of pregnancy there was less difference between the freezing points of amniotic fluid and maternal serum than at term. Our data would seem to bear this out. A comparison of the freezing points in Tables III and IV shows that the average freezing point difference at term between maternal serum and amniotic fluid was 0.50 degrees C while the average for the earlier months of pregnancy was only 0.20 degrees C. (The only instance in which the amniotic fluid was slightly hypertonic to the maternal serum occurred in this group Case 31.) This is even more strikingly brought out in Figure 1 which shows a definite tendency for the difference in freezing point between amniotic fluid and maternal blood serum; i.e. the hypotonicity of the amniotic fluid to increase as pregnancy advances. It should be noted that in two of our earliest cases 29 and 35 the amniotic fluid and maternal serum were essentially isotonic. To make the picture complete a similar relationship should exist in regard to chlorides. It will be remembered that Zangemeister and Meissl found the average chloride content of the maternal serum to be 627 milligrams per 100 cubic centimeters while that of the amniotic fluid at term was 620 milligrams per 100 cubic centimeters. In spite of the fact that these values were so nearly identical the average

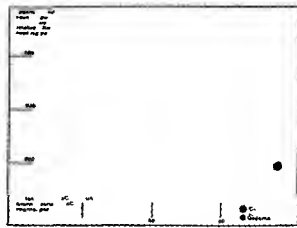


Fig 2 This figure shows the tendency for the chloride content in the amniotic fluid to increase as the freezing point difference decreases; i.e. when the amniotic fluid is most nearly isotonic with maternal serum the chloride difference between the amniotic fluid and maternal serum is greatest, approaching that found between protein poor edema fluid and cerebrospinal fluid and the blood serum.

The average chloride difference between edema fluids (the average cases containing less than 1 percent protein) and blood serum is with the average difference between normal cerebrospinal fluid and blood serum is indicated in the chart.

freezing point depression was -0.537 degrees C in the maternal serum and -0.487 degrees C in the amniotic fluid (Table II). They were at a loss to account for this difference in osmotic pressure with chloride values so nearly identical. Our data at first sight would seem to increase this difficulty for while our average figures for the freezing point of maternal serum and amniotic fluid at term -0.551 degrees C and -0.502 degrees C are analogous to theirs, our average chloride content of the amniotic fluid is actually greater than that of the maternal serum (maternal serum 604 milligrams per 100 cubic centimeters amniotic fluid 622 milligrams per 100 cubic centimeters Table III). Our previous experience with other body fluids has shown us that when a protein poor fluid is isotonic with the blood serum it will always have a considerably higher chloride content. The cerebrospinal fluid is an outstanding example. Here an excess of 140 milligrams per 100 cubic centimeters are found in the cerebrospinal fluid over that in the blood serum even though the freezing points of these two fluids are identical. In edema fluids peritoneal and

pleural fluids which have a considerably higher protein content than the cerebrospinal fluid the excess of chlorides over the serum is less. On this basis we would expect the amniotic fluid if isotonic with blood to have a chloride content considerably higher than that of the blood serum although not as high as that of cerebrospinal fluid for the amniotic fluid is not as poor in protein as the cerebrospinal fluid. A comparison of blood serum spinal fluid, and amniotic fluid is given in Table VIII. It will be seen that if the cerebrospinal fluid were diluted approximately 12 per cent it would have a composition as regards chloride sodium and freezing point approximately that of the amniotic fluid; i.e. it would be definitely hypotonic to the serum but would still have a considerably higher chloride content.

A further dilution would of course further lower the amniotic fluid chloride till eventually it would become less than that of the maternal serum. At such a point the amniotic fluid should be considerably hypotonic to the maternal serum. In 7 cases at term the chloride content of the amniotic fluid was less than that of the serum. This was never true in the cases in which the fluid was obtained earlier in pregnancy. In 6 of these 7 cases at term with lower chloride in the amniotic fluid than in the maternal serum the freezing points were determined and the differences ranged between -0.55 and -1.04 degrees C with an average of -0.69 degree C while in the 12 cases at term with higher chloride content in the amniotic fluid than in the maternal serum and hence presumably less dilution of the amniotic fluid the freezing point differences ranged from -0.21 degree C to -0.66 degree C with an average of -0.40 degree C. In the 10 cases at 8 months pregnancy and earlier in all of which the chloride content of the amniotic fluid was greater than that in the serum the freezing point differences were even less averaging 0.20 degree C. This relationship between freezing point and chloride differences is further illustrated in Figure 2. There is therefore a general correlation in the freezing point and chloride data which could be interpreted as indicating a gradually increasing dilution as pregnancy

progresses of a fluid originally not unlike the cerebrospinal fluid in composition. The composition of the fetal urine is such that if added to the amniotic fluid in suitable amounts it would produce such dilution. There are many irregularities however in this correlation which are difficult to explain particularly in Cases 29 and 35 where maternal serum and amniotic fluid are isotonic a much greater excess of chloride in the amniotic fluid than actually occurs would be expected. Undoubtedly unknown factors complicate the picture.

SUMMARY

The amniotic fluid contains small amounts of a fermentable reducing substance which is undoubtedly glucose. It contains creatinine or creatinine like substances in slightly greater concentration than the maternal serum. Its protein content varies from 105 to 502 milligrams per 100 cubic centimeters at term. It has slightly less sodium and usually slightly more chloride than maternal serum at term. In the earlier months of pregnancy the chloride in the amniotic fluid is always greater than that of the maternal serum. At term the amniotic fluid is distinctly hypotonic to maternal serum but in the earlier months of pregnancy this hypotonicity is less and in the earliest months the amniotic fluid may be isotonic with maternal serum. Thus early in pregnancy the amniotic fluid approaches the composition of other protein poor fluids which are in osmotic equilibrium with the blood plasma. This suggests that the amniotic fluid originates as a dialysate in equilibrium with the maternal and fetal body fluids. The fetal urine is definitely hypotonic and is present in the bladder as early as the fourth month in pregnancy. This indicates that as pregnancy advances the amniotic fluid becomes more and more diluted by the hypotonic fetal urine.

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PYELOSCOPY

A FURTHER CONTRIBUTION TO THE EXPERIMENTAL STUDY OF THE CONTRACTIONS OF THE KIDNEY PELVIS¹

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H ry A t t Gyn J g t W m H p J M l bo m

IN former contributions (3, 4) the author has drawn attention to the clinical and experimental evidences of the contractions of the kidney pelvis. The calyces and pelvis of the kidney constitute a muscular collecting mechanism for the urine secreted by the kidney and brought down by the collecting tubules. The urine thus collected in the calyces is passed by contraction of the calyces (contracting in succession from above downward) through communicating channels to the body of the pelvis. During the systole of the calyx the corresponding communicating channel relaxes and then contracts again at the end of the calycal systole thus constituting a muscular valve. When the three calyces have completed their systole the body of the pelvis which during this period has been relaxing to accommodate the urine passed in from the calyces contracts with a snap like action (hence suggesting the name ventricle of the pelvis) and the globule of urine is passed in to the ureter along which it is carried by a peristaltic wave.

CLINICAL OBSERVATIONS

In making further observations on this subject several points of interest arise. Apparently in the contraction of the calyx the attachment around the bases of the pyramids constitutes more or less the fixed point and the contraction of the calyx commences at this point. This is in the region of the muscularis spiralis papillæ of Muschat (7). As regards the communicating channel this becomes shorter as well as wider during the period of relaxation and conversely during its period of contraction it becomes narrower and longer. Observing a series of kidneys both by pyeloscopy and pyelography it appears that in general the lumen of each of the two upper communicating channels becomes quite obliterated at the moment of maximal contraction while the communicating channel between the lower calyx and the body of the pelvis often remains more or less patent during the systole of the ventricle any great degree of regurgitation being apparently prevented by the fact that the first part of the ventricle

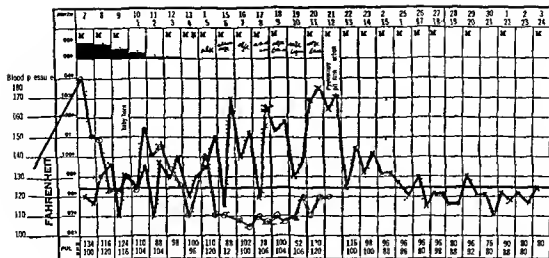


FIG. 1. Chart of Mrs. F. B. Pyelitis due to dysfunction cured by a single injection of pituitrin. Patient had had 8 convulsions before admission to hospital and one at 11:10 a.m. lasting 90 seconds after admission. The top row of figures indicates days in hospital. The second row of figures indicates days after birth of child. The shaded areas indicate the quantities of urine. The heavy line shows temperature curve; the parallel lines the blood pressure curve.

to contract during its systole is the part in relation to the communicating channel and also the fact that the lower calyx is more or less completely contracted being at the end of its systole when the ventricle commences its systole. It was also noticed that quite commonly the uppermost communicating channel was much longer and narrower than the others and one can easily understand how much more readily spasm could be set up in this part with consequent dysfunction and this too was often observed in cases of pyelitis and 'kidney pain'. One may concede that as a general rule dysfunction of any low viscus is accompanied by pain, and restoration of normal function gives relief from this pain. This condition of dysfunction no doubt accounts for many cases of obscure kidney pain in which chemical and bacteriological examination of the urine and ordinary pyelographic examination yield only obscure findings as regards causation but in which pyeloscopy will often solve the diagnosis. An interesting feature is this: quite often patients have suffered from pain or the symptoms of pyelitis off and on for weeks, months or even years and on pyeloscopic examination some form of dysfunction has been revealed on instituting some medical treatment often a single injection of morphine, eserine, pituitrin, or flavine the underlying neuromuscular cause of the

dysfunction has been disturbed and normal function restored and the patient is cured and often remains cured. The accompanying chart (Fig. 1) illustrates one such case the history of which is briefly as follows:

Mrs. F. B. aged 18 years primipara was admitted to the Women's Hospital Melbourne on April 7, 1930 suffering from eclampsia she having had 8 fits before admission. She had one convulsion after admission. She received conservative treatment and was delivered 4:15 a.m. on April 9. On April 15 her temperature was 103 degrees F, pulse 128 and she complained of marked tenderness in the right loin. Urinalysis disclosed acid reaction and the presence of pus which contained bacillus coli communis on culture. Patient was put on citrates and the usual medical treatment for pyelitis but without relief. On April 21, 1930 pyeloscopy was done and disclosed dysfunction of the kidney pelvis and ureter dilated upper calyx spasm of long communicating channel from upper calyx and relaxation of channel to lower calyx marked antiperistalsis in upper ureter with great pain not relieved by injection of morphine $\frac{1}{4}$ grain. She was relieved in 10 seconds by injection of 1 cubic centimeter of pituitrin with restoration of normal kidney pelvis and ureter action. Patient has been quite well since.

The fact that the mere passage of the ureteral catheter did not relieve the condition is to be noted nor did an injection of morphine but an injection of pituitrin was specific in this case.

In observing the contractions of the kidney pelvis the thought continually obtrudes itself

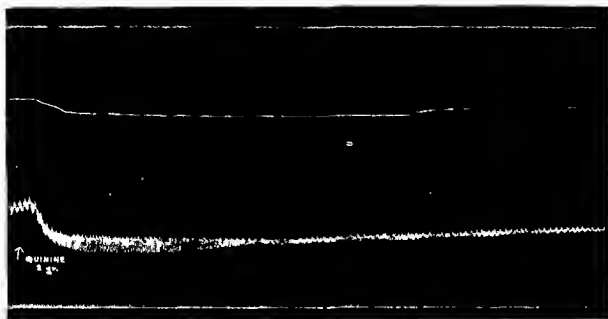


Fig 2 Action of quinine

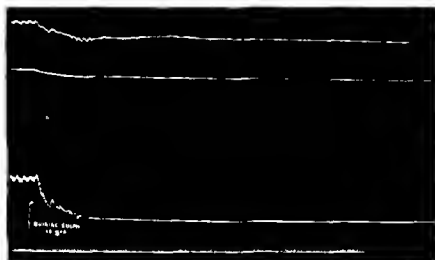


Fig 3 Effect of fatal dose of quinine

What is happening to the rest of the kidney while these various parts of the pelvis are contracting and relaxing? One must recognize of course that the kidney is not enclosed in an absolutely rigid membrane otherwise naturally the records obtained in the experimental animal when the kidney is placed in an oncometer would not be possible. This was investigated and will be referred to later.

Again, What happens at the orifices and ends of the collecting tubules when the calyces contract? Do the active contraction and relaxation of the calyces and the efficient emptying of the pelvis facilitate the passage of urine from the collecting tubules and thus indirectly increase the quantity of urinary flow and on the other hand does sluggishness of this musculature impede the urinary outflow from the

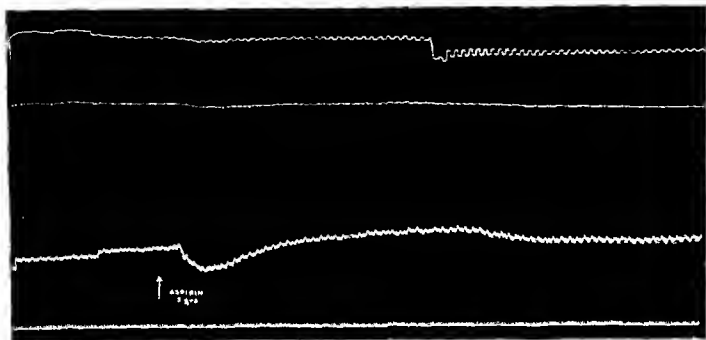


Fig 3 Action of aspirin

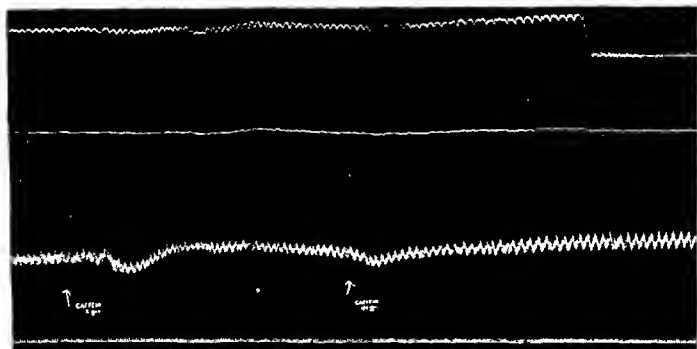


Fig 4 Action of caffeine

collecting tubules and thus diminish the total amount of urine produced? Is the diuresis induced by some drugs such as pituitrin or caffeine accounted for in this way? Does the activity of the pelvic musculature and the muscularis spiralis papillæ of Muschat so rhythmically affect the renal circulation as actually to influence the amount and degree

of the vascular pulsation 'in the kidney in the same way as the respiratory movements affect the flow to and from the heart, or does it act simply by mechanically facilitating the removal of the urine and thus increase secretory activity by diminishing the mechanical resistance to secretion ('back pressure')? What conditions too, predispose to the de

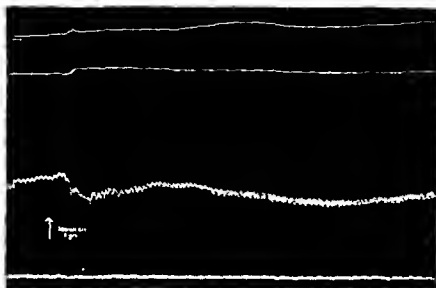


Fig 5 Action of citrate of soda.

development of the various types of dysfunction especially spasm of a communicating channel or ureter with or without antiperistalsis and what are the exciting causes? These and many other problems must be investigated from the clinical and experimental sides both and the observations herein recorded are an attempt to elucidate some of them

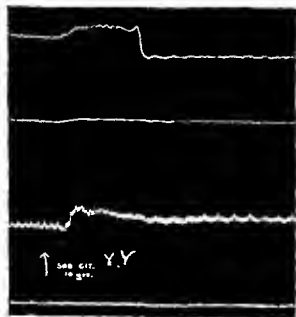


Fig 6 Effect of section of vagus nerves immediately after injection of citrate of soda

EXPERIMENTAL

The graphic method described by the author in a former communication (4) was used but at the same time the kidney was enclosed in an oncometer which registers alterations in kidney volume which alterations are usually regarded as being due to alterations in arteriolar volume. It will at once be seen from the tracings that although in some cases alterations of kidney volume and renal pelvis volume apparently run parallel in other cases one sees alterations in kidney volume without apparently any alteration in renal pelvis volume and vice versa but still one feels that occasionally the one may be a disturbing element in the faithful recording of the other and wherever possible experimental conditions were set up aiming at eliminating disturbing factors

Drugs The actions of various drugs were investigated some on account of their known diuretic action and others for special reasons. From time to time certain drugs have been held up as being specifics for pyelitis when intravenously injected and more recently mercurochrome and acriflavine have had a vogue here. The drugs are excreted in the urine and are supposed to exert a direct antiseptic action on the urine in the kidney pelvis. From the small doses used one has felt that after injection the dilution in the blood and



Fig 7 Action of pituitrin (See also Fig 8A)

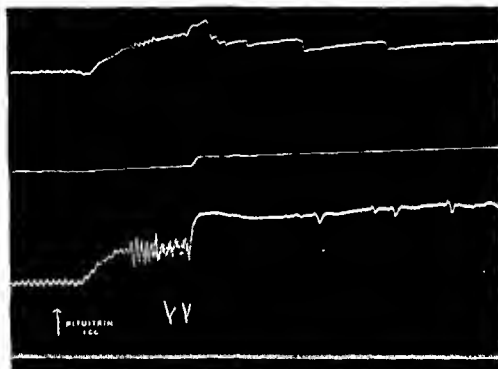


Fig 7A Effect of section of vagus nerves after injecting pituitrin

urine are so great that there can be no question of any antiseptic action and that therefore any beneficial action due to these drugs has been due to some local physiological action. As will be seen later, both these drugs have a histamine like action due either to their liberating a histamine type of body in the circulation or having a histamine type of action in themselves.

The drugs which were investigated were quinine, aspirin, caffeine, sodium citrate, pi-

pituitrin, eserine, atropine, adrenalin, histamine (ergamine), acriflavine, mercurochrome. The effects of section of the vagus nerves on the action of certain drugs was also investigated.

EXPERIMENTAL RESULTS

Synchronous tracings of blood pressure, kidney volume (oncometer) and contractions of the kidney pelvis were taken. The animals used were medium sized dogs which had received an injection of 4 grains of morphine

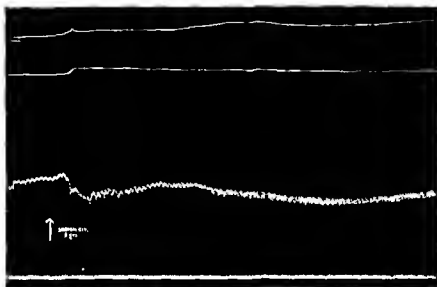


Fig 5 Action of citrate of soda

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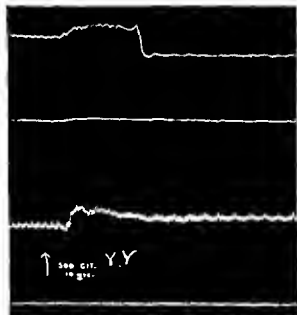


Fig 6 Influence of section of guinea pigs innervated by after injection of citrate of soda

EXPERIMENTAL

The graphic method described by the author in a former communication (4) was used but at the same time the kidney was enclosed in an oncometer which registers alterations in kidney volume which alterations are usually regarded as being due to alterations in arterial volume. It will at once be seen from the tracings that although in some cases alterations of kidney volume and renal pelvis volume apparently run parallel in other cases one sees alterations in kidney volume without apparently any alteration in renal pelvis volume and vice versa but still one feels that occasionally the one may be a disturbing element in the faithful recording of the other and wherever possible experimental conditions were set up aiming at eliminating disturbing factors

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Fig 7 Action of pituitrin (See also Fig 8A)

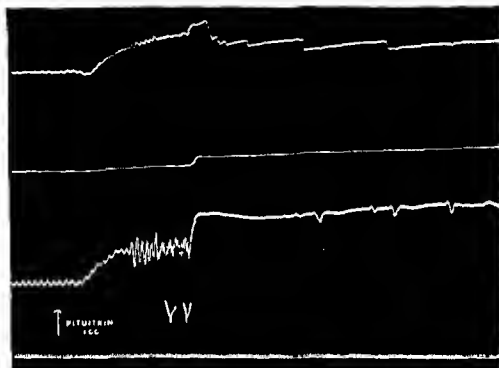


Fig 7A Effect of section of vagus nerves after injecting pituitrin

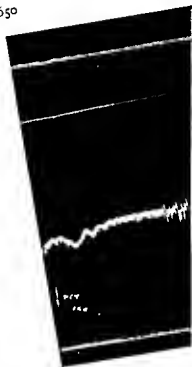
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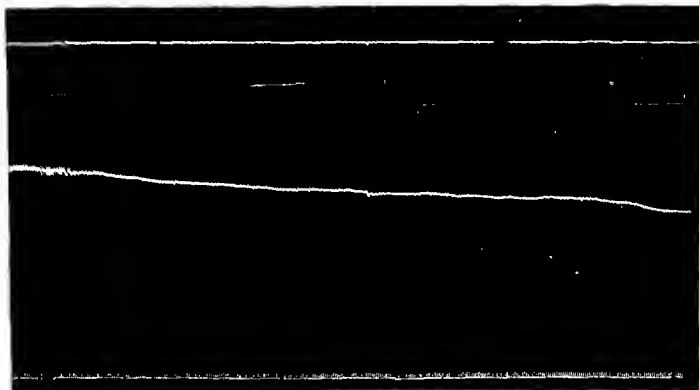
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atropine after pituitrin

val between the peristaltic waves of the pelvis. These waves persisted even when the animal died and the blood pressure had fallen to zero and the animal's heart beat and respirations had ceased (Fig. 2A).

Aspirin (Fig. 3) produced a slight fall in blood pressure with no apparent effect on kidney vessels. The pelvis showed slight relaxation with increase in

amplitude of the rhythmic contractions. (In the human being when the kidney pelvis is being examined with the fluorescent screen a general slowing up of the peristaltic waves is seen in cases in which the pelvis is contracting vigorously and quickly.)

Caffene (Fig. 4) produces a slight rise in blood pressure while the kidney volume remains practically unaltered but the kidney pelvis shows a definite

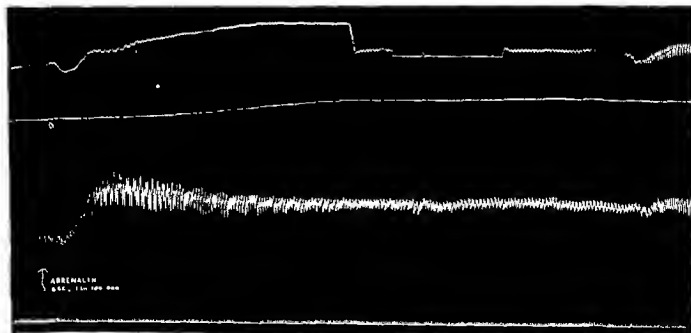


Fig. 9 Action of adrenalin

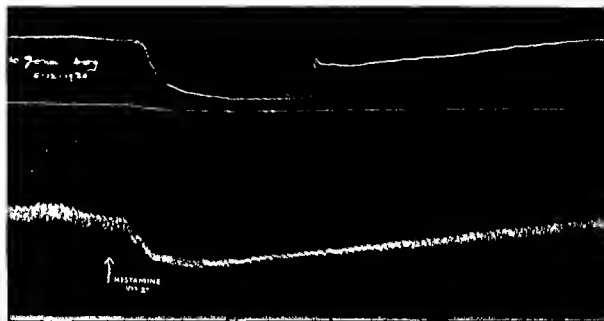


Fig. 4. Atropine shows effects on blood pressure of kidney pelvis with and without effect of atropine.

sustained contraction with marked increase in the amplitude of the peristaltic waves. This effect is more marked with a dose of $\frac{1}{4}$ grain of caffeine than with a $\frac{1}{4}$ g dose and disappears after the injection of quinone.

Citratine (Fig. 5) produces a slight vasodilation with fall in blood pressure but a definite sustained contraction of the kidney pelvis with increase

in amplitude of the peristaltic waves. The contraction of the pelvis is maintained for a much longer period when the vagi are cut after the injection of the citrate (Fig. 6).

Pituitrin as described in previous papers (3, 4) causes contraction of the pelvis of the kidney and a hurrying of the peristaltic waves in the pelvis and down the ureter. This latter effect is shown in Figure 7. The usual effect on the blood pressure is shown. Clinically in cases in which there is dysfunction, e.g., as in the case of the patient F. B. quoted above, a single dose of pituitrin is often sufficient to correct the dysfunction and re-establish normal function.

Eserine causes contraction of the kidney pelvis.

Atropine in the human being causes a definite relaxation of the kidney pelvis often accompanied by pain which is relieved by morphine. *Eserine* or *pituitrin* which induces a contraction. In the dog, however, a contraction is sometimes apparently obtained but this is possibly due to the release of some pressor action but further work on this point is necessary. Its chief action appears to be the cutting out of vagal control which seems to be a real thing in the dog for when the vagi are cut or atropine injected immediately after an injection of *savpitritrin* or sodium citrate, a marked increase in the contraction is produced (Figs. 6 and 8).

Adrenaline causes a steady contraction of the pelvis coming on long after the blood pressure has reached its maximum and lasting long after the blood pressure has come back to normal (Fig. 9).

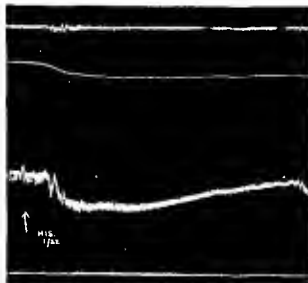


Fig. 5.

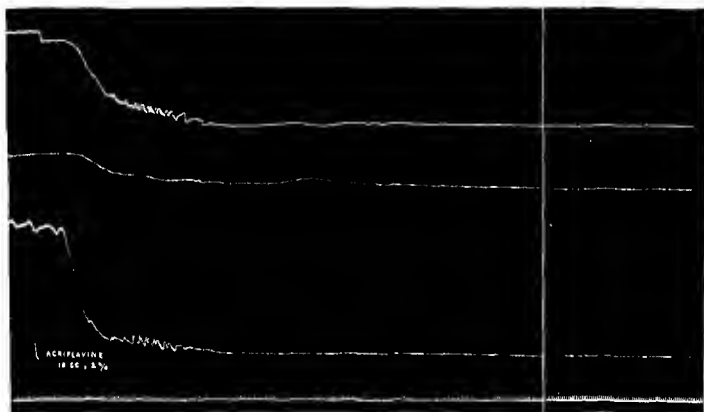


Fig 11A Action of fatal dose of acriflavine Note contractions of kidney pelvis after death of animal (White line indicates break in chart)

Histamine (Fig 10) produces a fall in blood pressure a passive or secondary constriction of kidney vessels often being associated with the fall in blood pressure and at the same time a relaxation of the kidney pelvis. Numerous tracings obtained demonstrate that these two latter phenomena are quite independent of one another and that the movements of the writing lever attached to the pelvis of the kidney are in no way parallel to and are quite independent of the movements of the writing lever attached to the oncometer.

Acriflavine (Fig 11) Five cubic centimeters of a 2 per cent solution of acriflavine (i.e. 0.1 gram acriflavine) gives a tracing practically identical with that produced by 0.003 gram histamine (ergamine) but slightly less potent.

Mercurochrome (Fig 12) Fifteen cubic centimeters of a 5 per cent solution of mercurochrome (i.e. 0.75 gram mercurochrome) gives a tracing practically identical with that produced by 0.003 gram histamine but somewhat less potent.

As regards vagal control the tracings obtained after section of the vagi or injection of atropine certainly suggest that the vagus exerts an inhibitory action on the contractility of the kidney pelvis musculature.

An interesting feature noted was that the kidney enclosed in the oncometer failed to secrete urine although the urinary flow was definite both before the kidney was placed in

the oncometer and after it was removed. This leads one to think naturally of the operation of decapsulation of the kidney performed with

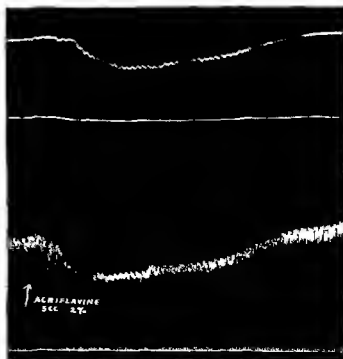


Fig 11 Action of acriflavine



Fig. Action of mercuriochrome

at least temporary success in some cases where the kidney fails to secrete

RESULTS

The various activities taking place in the kidney are very complex. Not only have we the phenomena of filtration and secretion and reabsorption in the various essential parts of the kidney but the vascular phenomena are also complex the most important being the rhythmic flow of blood through the kidney by variations in the pressure of the outflowing blood in the renal vein—this rhythmic flow being recognized as also essential to the secretion of urine the mere maintenance of a head of pressure in the renal artery and an outflow from the renal vein though sufficient for secretion is not adequate for normal purposes (2). In addition to all this we have the rhythmic activity of the musculature of the pyramids calyces communicating channels and body of the pelvis. The whole kidney being contained in a more or less but not absolutely resistant and inelastic capsule one is bled by the innumerable possibilities of action and interaction. The demonstration of the action of various drugs not only on the condition of tone or degree of contraction or relaxation of the kidney pelvis and its various parts but the effect of these various drugs on the rhythmic

activity of this musculature opens up many possibilities. Two drugs in particular stand out sodium citrate and caffeine. One has always felt that the diuretic action of citrates was due in large measure at least to the hydrostatic plethora induced while the action of caffeine was supposed to be some obscure specific action on the secreting cells of the kidney. While we may still regard these modes of action as true the direct action on the musculature of the collecting system from the pyramids to the ureter with a milking effect may be quite a considerable factor in determining the diuretic action of these drugs. The action of those drugs also which induce or stimulate peristalsis or facilitate emptying of the renal pelvis either by contraction of the pelvis such as pituitrin or eserine by increasing the peristaltic waves such as caffeine and sodium citrate or by inducing a measure of relaxation in some part of the collecting system musculature which is in a condition of spasm and ensuring uninterrupted peristalsis with free outflow of urine such as would be induced by histamine mercuriochrome and acriflavine in appropriate dosage—all these actions must produce a decidedly beneficial effect in those cases where there is backworking or stagnation of urine in the collecting system. Pyeloscopy determines some such dysfunction in cases of pyelitis and in many cases of obscure kidney pain and once the underlying pathological process has been determined all that is necessary to cure the condition is the exhibition of the appropriate drug in the optimum dose to restore normality. The optimum dose is certainly a point to be considered as overdosage may be just as prejudicial to a successful result as faulty diagnosis or incorrect therapy the correct dose being one which will say cause sufficient relaxation to relieve spasm but not sufficient to cause dilatation of the pelvis with backworking and exaggeration of symptoms. This latter will no doubt explain some of the failures obtained with forms of therapy which had proved successful in other cases of similar type. One certainly recommends that the therapy to be followed should be determined so far as possible while the kidney is being observed under the fluorescent screen. The very definite and

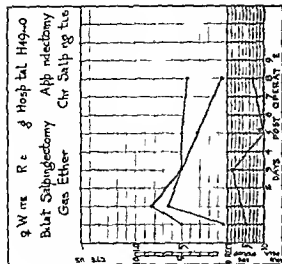
marked effect of bistamine raises many problems in the pathology of renal pain. One has seen renal pain severe and resistant to all forms of treatment and yet associated with apparently no other abnormality than a mild bacilluria generally *bacillus coli communis*. Whether the *bacillus coli communis* or any other organism has the power to liberate histamine like bodies locally or whether they are formed elsewhere and, passing through the circulation, only exert an action on the kidney as part of their general action remains to be proved. The common association of bowel trouble most commonly constipation with pyelitis is recognized, as also is the difficulty sometimes experienced in the differential diagnosis of right sided pyelitis from gall bladder or appendical trouble. The history comes to him still complaining of a deep seated right sided pain after having had three operations—appendicectomy, then gall bladder drainage, and then cholecystectomy—and in whom pyeloscopia determined spasm of a very long communicating channel from the upper calyx. She was cured by eserine. The association of the pyelitis with toxæmia, pyrexia and shivering suggest that a common factor is at work in regard to the causation of the local renal dysfunction and the general symptoms. The author some years ago (5) demonstrated that the pyrogen which was isolated from broken up bacteria and which produced pyrexia when injected into the experimental animal was a relatively simple body of the amine type on a fatty acid basis and was apparently related to histamine which was discovered and so thoroughly worked out by Dale and his collaborators (1). In this connection the work of Koessler and Hanke (6) is suggestive. These authors have shown that *bacillus coli*

communis will convert histidine (a 6 carbon degradation product of protein) into bistamine in the presence of glycine or glucose and a source of nitrogen (the nitrogen and the glucose or glycerine being essential). The conditions found in the howel would certainly comply with these requirements especially where conditions of bacterial fermentation of undigested foodstuffs exist. A vista of further possibilities and speculations is opened up by this work but a discussion on these lines would be out of place and unnecessary here as it is merely the author's desire to attract the attention of the practical clinician to the value of pyeloscopia as an aid to diagnosis and therapy in this branch of abdominal medicine. Further work is being done from the clinical side in the direction of obtaining graphic records of the activity of the human kidney pelvis. For this work we are using an apparatus slightly modified but on the lines of that used in the experimental work here described and it is hoped to publish the results of this work in due course.

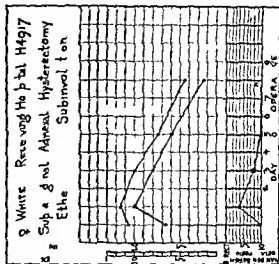
I desire to express my thanks to Professor W. A. Osborne for the use of his laboratories and facilities.

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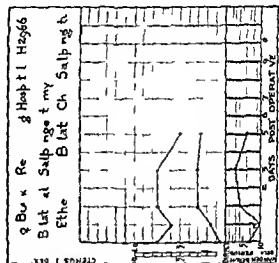
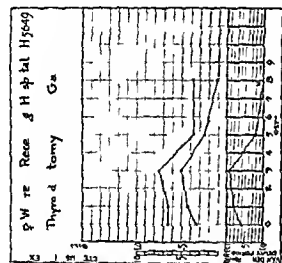
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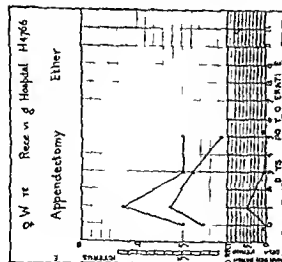
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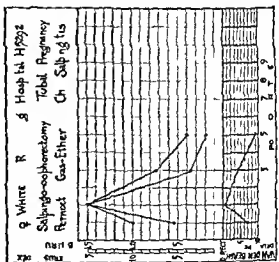
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POSTOPERATIVE LATENT JAUNDICE¹

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Assistant in Medicine, Boston University School of Medicine

DURING a survey of the incidence of latent jaundice icteric Wassermann sera were routinely examined for a period of 7 weeks at St. Mary's Hospital, Detroit, Michigan, by the use of the icterus index, van den Bergh reaction and quantitative serum bilirubin determination. Sera were selected because they appeared more yellow than normal. Almost invariably latent jaundice was encountered in such sera by one or all of the three tests representing about one out of eight of the sera routinely taken for the Wassermann test. Two hundred sera were thus examined and the records of the patients carefully studied.

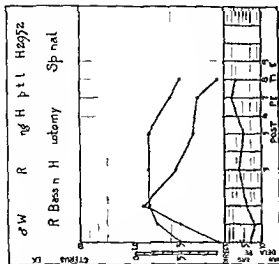
About 75 of these sera were taken from patients admitted because of accidental trauma or from patients who had just returned from the operating room. The remainder were from patients with lobar pneumonia, pernicious anemia, recognized and unrecognized familial jaundice, septicemia, cardiac failure (rheumatic or luetic etiology), acute upper respiratory infection, acute follicular tonsillitis, peritonsillar abscess, acute salpingitis, acute epididymitis, extravasation of urine, diabetes mellitus, carbon monoxide, carbon tetrachloride, lead and iodine poisoning, hepatic cirrhosis, alcoholism, cerebral hemorrhage, metastatic carcinoma of the liver, carcinoma of the head of the pancreas, acute cholecystitis, duodenal ulcer, infectious ('catarrhal') jaundice, pernicious vomiting of pregnancy, thromboangitis obliterans, incomplete abortion and a few from the cords of the newborn.

Charts 1 to 20. On these charts there are three curves. The upper curve is invariably that of the icterus index; the middle curve that of the quantitative bilirubin with their scales as indicated at the left. At the bottom the van den Bergh reaction curve is plotted in terms of its delay period, a dot on the direct line indicating the direct positive reaction. The delay period scale is in minutes. A circle on the direct line indicates the presence of an immediate golden reaction when the reagent mixes with the serum. An 'N' at the bottom indicates that the direct reaction was negative up to 10 minutes. 'O' day is the day of operation, blood being taken immediately on return from the operating room.

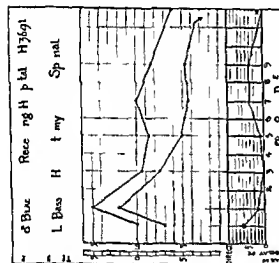
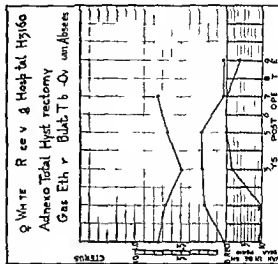
The technique used for the icterus index was the colorimetric method described by Bernheim for the van den Bergh reaction, that of its originator for the quantitative bilirubin, the modification developed by Thannhauser and Anderson. The normal icterus index was considered to be from 3 to 5 with satisfactory sera and the normal bilirubin content below 0.2 milligrams per 100 cubic centimeters of serum (6). As for the van den Bergh reaction and its interpretation it was deemed advisable to revert to the terminology described by van den Bergh himself in his recent reissue of *Der Gallenfarbstoff im Blute* rather than to attempt to sort out the confusing array of conflicting ideas from other sources.

In contusions, fractures, deep lacerations, bullet wounds, operative incisions, cerebral hemorrhage and ruptured ectopic pregnancy, an interstitial blood extravasation is a common factor. One cubic centimeter of blood alone contains approximately 140 milligrams of hemoglobin from which an appreciable quantity of hemoatoidin may be formed. Rich has pointed out that this hemoatoidin is formed at the site of the extravasation and is so far as is known identical with bilirubin. Hence in all of these conditions it may be assumed that an excess of bilirubin is formed and released into the blood stream to be excreted by the liver. Latent jaundice following the rupture of ectopic pregnancy is well known (3) and the latent jaundice of true cerebral hemorrhage has been demonstrated by Wilder and again by Cheney. Latent jaundice also results from traumatic interstitial blood extravasation (1) as indicated on the accompanying table and charts.

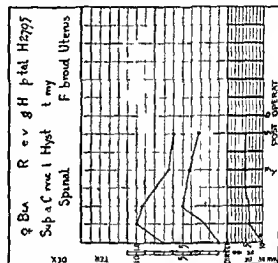
Table I exhibits the findings in a representative group from 63 cases found by the examination of Wassermann sera during a period of 7 weeks at St. Mary's Hospital, Detroit, Michigan. A wide variety of accidental lesions without any organic disease is represented. It is to be noted that direct



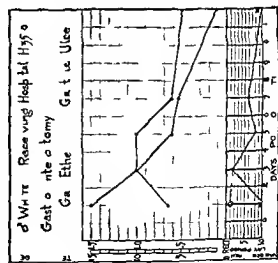
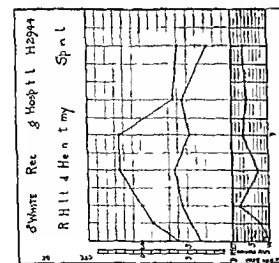
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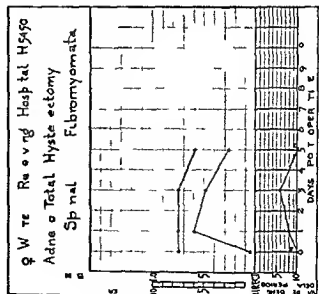
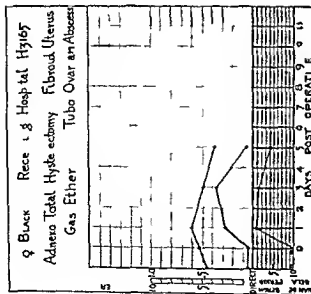
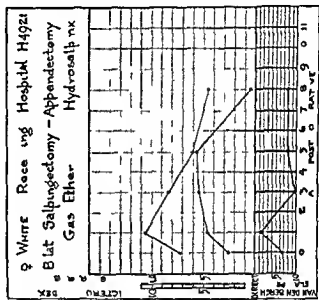
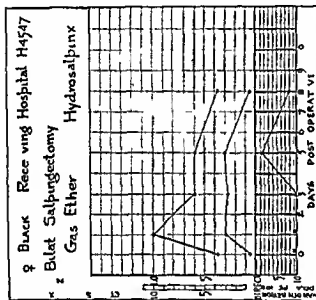
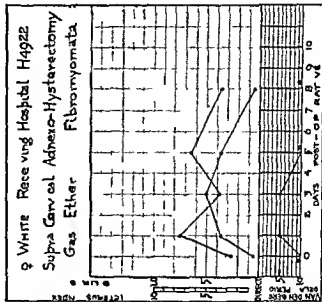
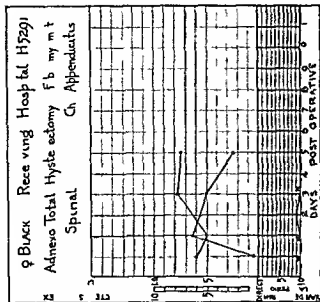


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Fifty patients were observed after operation all of whom exhibited some degree of latent jaundice in one or all of the three tests except in an occasional hamorrhoidectomy. Twenty of these were studied serially with the three tests and are charted. Zonal positive reactions were usually immediate if the delay period in the van den Bergh reaction after subsequent mixing was 2 minutes or less but are not recorded on the charts. The striking feature of these charts is that although the liver function of these patients as well as of those suffering from accidental trauma can hardly be regarded as impaired there is evidence of a definite direct positive tendency in the van den Bergh reaction during the excretion of the overload of bilirubin. The nature of the anæsthetic used was quite irrelevant. No chloroform was used. The amount of pigment to be excreted as well as its rate of release undoubtedly varied somewhat dependent on the type of incision made the extent of the extravasation and the relative vascularity of the area involved. Frank direct positive reactions are shown in Charts 12, 19 and 20. Immediate zonal reactions were present at the time of the short delay periods on Charts 2, 3, 14 and 17. All charts exhibit more or less the direct positive tendency. Chart 20 exhibits the development of a direct positive reaction on the third day after operation in a case of familial jaundice recognized only after herniotomy

and maintaining an anomalous immediate direct golden reaction until the tenth day.

SUMMARY

Latent icterus develops following trauma accidental or operative probably due to the release of a surplus of bilirubin from the interstitial blood extravasation. In a study of 20 consecutive patients undergoing an uneventful postoperative recovery after a wide variety of operations in whom either general or spinal anæsthesia was used it is found that there is evidence of a definite direct positive tendency in the van den Bergh reaction that is difficult to explain by any known pathological process in the liver and which appears to be associated only with the excretion of a surplus of bilirubin.

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THE COMMON BILE DUCT¹

JOHN B DEEVER M D AND V G BURDEN M D PHILADELPHIA

THE surgical treatment of disease of the biliary tract in the past and present has been concerned chiefly with affections of the gall bladder. In this period of 50 years there has been ample time and experience to evaluate results. It has been the privilege of the senior author to be an active participant throughout this half century of surgical progress. In retrospect on contemplation of the good and evil in this special field of surgery there stands out with the prominence of indelible memory the role of the common duct. It requires much hither and trying experience adequately to appreciate the importance of the common duct in the satisfactory and unsatisfactory results of surgery of the biliary tract. Unlike the gall bladder the common bile duct is indispensable yet it is so readily affected by disease and operative trauma the consequences of which are often disastrous that its surgical importance scarcely can be overestimated.

Anatomically the common bile duct lies in the right free border of the gastrohepatic omentum then behind the duodenum between the duodenum and the pancreas or in a groove in the head of the pancreas whence it enters the wall of the duodenum through which it passes obliquely to its terminal opening the papilla of Vater surrounded by the sphincter of Oddi. The first or supraduodenal portion is not always present for the reason that in some instances the hepatic duct is prolonged down to the outer border of the duodenum before it is joined by the cystic duct. The supraduodenal portion of the duct in the gastrohepatic omentum is accompanied by the hepatic artery and portal vein and by several lymphatic glands external to the omentum. The intimate relationship between the duct and nearby structures—the gall bladder the pylorus the duodenum and the pancreas—makes it subject to mechanical and infectious derangements consequent upon disease of these organs.

From its gross appearance the common duct appears to be a passive channel for the transit of bile. In view of the surgical importance of the duct a detailed description of its finer anatomy should be of value. But such cannot be found in modern textbooks of anatomy. The older anatomists described glands in the walls of the extrahepatic bile ducts. The presence of muscular tissue has been disputed. Burden carried out microscopic studies on the extrahepatic ducts of the human subject and gave a description of the surgical histopathology. When the common duct is laid open the internal surface presents a characteristic appearance and at first seems to be reticulated but on closer inspection under the dissecting microscope it is seen to be covered by minute pits or shallow depressions some of which contain plugs of mucus. Cross sections of the duct show a lining layer of tall columnar epithelium not unlike that which covers the rugæ of the gall bladder. Beneath the lining layer is a thick compact layer of connective tissue which contains considerable elastic tissue. The outer layer of the duct wall is composed of loose areolar tissue in which are found blood vessels lymphatics and muscle. The muscular layer is composed of good sized isolated oval bundles of unstriated fibers some of which are arranged in a longitudinal and others in a circular direction. The pits which appear on the internal surface of the duct are mere shallow epithelium lined depressions between folds of mucous membrane. Adjacent to the lumen of the duct and opening into it are ampulla like cavities lined with epithelium. Into these cavities drain the ducts of mucous glands which are found richly distributed throughout the wall of the common duct. The glands in the wall of the duct are of particular interest since it was found that in patients who had cholecystitis the glands constantly showed inflammatory changes characterized by surrounding round cell infiltration and cystic changes. The

surgical significance of these findings in the wall of the common duct is important in their bearing on the sequelæ of biliary tract infection. An infection so situated is difficult to eradicate and the consequences may seriously jeopardize the integrity of the main bile channel. Thus it appears that cholelithiasis does not merely express or signify a catarrhal condition of the lining of the bile duct.

Some of the gross lesions affecting the common duct are stone, stricture, ulceration and neoplastic growths. It may also be involved by infection and adhesions extending from adjacent structures as the gall bladder, duodenum, pancreas and regional lymph glands.

The location of the duct and its topographical relations make the part it plays in biliary tract infection highly important. The third part, the pancreatic and the fourth the interstitial, are its most important portions. The terminal portion is dilated, forming the ampulla of Vater and terminates as the papilla of Vater surrounded by the sphincter of Oddi, making it the more important of the two latter portions. This has been shown more particularly in the last few years during which time more operations have been done for biliary tract infection, thus offering greater opportunity for the better interpretation of the pathological findings, and also since biliary tract drainage by duodenal tubage has occupied a prominent place in the medical treatment of biliary tract infection. We refer particularly to the influence which the sphincter of Oddi has upon the drainage of the common duct and the filling of the gall bladder and the part it plays in the pathology of the duct.

Other pathologic conditions found in the common duct are inflammation (choledochitis), stricture, ulceration and perforative ulceration, stone, distention with muddy, sandy bile, neoplastic growth and diverticulum, which if large results in cystic dilatation of the duct. The traumatic conditions include section, tear or removal of a portion of the wall and ligature, all of which if not recognized at the time of occurrence and repaired result in a bile fistula or permanent jaundice. Any one of these conditions may result in failure of the original operation to give relief. Fur-

ther they leave the patient worse off than before the operation. Although the traumatic conditions may occur in the hands of the most expert surgeon, nevertheless they are an insult to surgery and decidedly detract from the sum total of beneficial results.

Let us next analyze the pathologic and traumatic conditions. Inflammation of the common duct in the majority of instances is a result of cholecystitis. The second most common cause, a contributory one, is stone in the common duct, since in almost every such instance there has been an antecedent cholecystitis. The presence of the stone in the duct, because it is a foreign body and because it causes a varying degree of biliary obstruction, acts to intensify the local inflammatory reaction and even may give rise to ulceration.

Inflammation of the duct is recognized through sight and touch by the presence of dilatation and by opacity and thickening of the walls. The normal duct is about 6 or 7 millimeters in diameter and has a blue color similar to that of the gall bladder. Ordinarily it cannot be palpated as a separate structure in the gastrohepatic omentum because of its thin collapsible walls. Palpatory examination of the duct is carried out by inserting the tip of the index finger into the foramen of Winslow and gently compressing the overlying structures between the finger and the thumb. When the foramen of Winslow is occluded by adhesions this method of palpation cannot be done satisfactorily unless one is able to define by touch the border of the gastrohepatic omentum. The latter may be thick and indurated and have overlying enlarged lymphatic glands. When in doubt the duct may be directly inspected by incising the gastrohepatic omentum along its right free border. When the history is suggestive of stone in the common duct it has been our experience that negative palpatory findings are not reliable and we do not feel satisfied until the duct has been opened and its interior examined by touch if possible and by the probe.

Stricture of the common duct is always followed by jaundice which may be intermittent or permanent. In many cases the symptoms cannot be distinguished from those of common duct stone. Where the type of jaundice

is intermittent the explanation is probably that the stricture has narrowed but not completely occluded the lumen and at certain times by reason of the character of the bile or local inflammatory edema the pathway becomes obstructed. Occasionally there is a stone above the stricture. A stricture of this type may exist for years. When the stricture is complete jaundice is permanent unless there be a biliary fistula above it. Formerly it was believed that stricture of the common duct was always due to injury but latterly since many more operations have been done for disease of the biliary tract and there has been more intensive study of the condition of the liver it is known to be sometimes the result of general obliterative cholangitis. In the absence of traumatism some cases are probably due to persistent postoperative cholelithiasis. Nevertheless operative injury remains as the most potent etiological factor in the condition. The stricture may be a local annular lesion or it may extend along the greater portion of the duct. Stricture at the terminal end may be difficult to detect unless probes be passed down toward the duodenum.

The glands in the wall of the common duct may harbor persistent infection which spreads by continuity of structure until it becomes widely disseminated along the bile tube. The inflammation in the wall of the duct results in infiltration with leucocytes, deformity and distention of the mucous glands and the formation of fibrous tissue leading to thickening and rigidity of the duct. Judd and Councillor carried out microscopic studies on the intrahepatic biliary tree and called attention to the fact that general obliterative cholangitis may exist for months before there are signs of stricture of the common duct. Stricture may be the result as already stated of cholangitis and ulceration. The pathologic changes result from infection of the glands within the walls of the duct as well as from the presence of stone. A stone that obstructs the common duct and causes proximal retention of bile may lead to ulcerative perforation and escape of bile into the subhepatic fossa. My former interne and your fellow member Dr. Vale has related to me such a case occurring in his experience. Distention of the common duct

with muddy sandy bile exposes the walls of the duct to changes which may result in partial obliteration of its lumen. Neoplastic growths may affect the common duct as extensions from carcinoma of the gall bladder or they may occur as a primary tumor of the duct which is most commonly situated at the terminus of the duct in the perampullar region.

Diverticula of the common duct are caused by obstruction in conjunction with a localized weakness of the wall. Rarely a traction diverticulum may be the result of adhesions. Congenital dilatation of the duct which may reach the size of the small intestine has been encountered in a few reported cases the causative factor being a diaphragm like occlusion at the lower end of the duct. The senior author on more than one occasion has encountered a diverticulum of the common duct large enough to constitute a cyst. Injury to the common duct during the course of operation unfortunately is not a rare occurrence. It usually affects the portion at the cystic duct junction. Strong traction on the gall bladder preparatory to removal may angulate the common duct at this point so that if the effort to remove all of the cystic duct be too ambitious the clamp may include a section of the wall of the common duct which will be excised and the applied ligature is then on the side of the main duct. Should the ligature hold and healing occur a stricture will follow. In case the ligature separates before healing a biliary fistula is formed. Sometimes the cystic artery escapes the clamp or ligature and retracts behind the main duct. Unless caution is observed in its recapture the hæmostat may be applied to the common duct. Edema and inflammatory exudate around the neck of the gall bladder and cystic duct make definition of structures difficult. In such instances it is wise to make a high ligation of the cystic duct. The watch word in surgery of the biliary tract is see well what you do. This applies particularly to surgery of the common duct. The normal relations of the duct are often distorted by disease so that even the expert is not able to recognize it by sight and touch. Identification of the structure in question often can be made by aspiration through

a long fine needle attached to a syringe. The aspirate bile or blood will distinguish between common bile duct and portal vein the two structures most readily confused. The surgeon should be acquainted with the more common anomalies of the ducts. By exposing the duct at a point where there is the least amount of pathological tissue it can be traced upward to the site of operation and handled with comparative safety.

Stricture of the common duct due to cholangitis may not give clinical manifestation for a considerable length of time after the primary operation. Postoperative intermittent biliary obstruction is always more or less suggestive of stricture. The lesion essentially is the result of inflammation and contraction which eventually infringes upon the patency of the lumen of the duct until there are clinical signs of impeded bile flow. In those cases usually hopeless of obliterative cholangitis encountered in infants it may be possible that the inflammation in the biliary tract was caused by toxins from the mother conveyed to the liver of the fetus.

Anatomically physiologically pathologically and surgically the ampulla of Vater rivals the gall bladder as the most important part of the extrabepatic biliary tract. Anatomically it is important because of its position in the wall of the duodenum where it is surrounded by the sphincter of Oddi. The sphincter plays a major role in the physiology of bile flow. It restrains the escape of bile into the duodenum until the contractile force of the gall bladder in conjunction with reciprocal innervation overcomes its normal tonus. It is the most important agent in causing the gall bladder to fill with bile. As one of us (V G B) pointed out in a previous paper the findings of cholecystography should be interpreted in terms of the behavior of the sphincter of Oddi. The most potent factor in the absence of the gall bladder shadow in the cholecystogram is incompetency of the sphincter of Oddi. Pathologically it is capable of playing a mischievous role when the sphincter is in spasm or when the peri ampullar structures are infiltrated by inflammatory exudate. Judd and Burden described a group of cases in which there was postoperative non calcu-

lous intermittent biliary obstruction probably caused by spasm of the sphincter of Oddi. Surgically under abnormal conditions of persistent contracture or spasm it figures prominently as an etiologic factor in pancreatic edema. Especially potent is its influence on the postoperative morbidity of biliary surgery. For years the senior author has called attention to this both by clinical demonstration and by the written page. Regardless of the type of operation on the common duct whether it be for inflammation stricture stone or neoplasm it is not complete unless the patency of the duct through to the duodenum has been demonstrated to complete satisfaction. Were it possible to remove half of the sphincter of Oddi as in the removal of the anterior half of the pyloric sphincter for pylorospasm there would be fewer residual conditions so disappointing to the surgeon and patient. One German surgeon has devised and uses graduated sounds for dilating the sphincter of Oddi. From our clinical experience we do not believe that experimental data relative to reflux of duodenal contents constitute a major objection to instrumental dilatation of the sphincter. Thoroughness is the keynote in surgery of the common duct. The sequelae of carelessness mentioned elsewhere are disconcerting legacies. Only by delicate searching and instrumental exploration can one be sure that the papilla of Vater is open unless there be an obstructing stone or neoplasm.

The surgical procedures which have been practiced on the common duct are varied and ingenious. Especially so are those which have to do with restoration of continuity of the main bile channel. The prime motive in all is an uninterrupted passage for bile into the intestine. The resourcefulness of the surgeon is often put to extreme test. These supreme difficulties should be undertaken only by the surgeon of long experience yet the unexpected occasion may arise in the practice of the average surgeon. He must be prepared to act to extricate himself and the patient from a trying situation. If the problem cannot be solved at once an immediate crisis can be averted by providing for an external biliary fistula leaving the final step of the operation

to a time when circumstances are more favorable. The more common surgical lesions of the common duct call for a thorough operative procedure which is conservative in its radicalism.

In the case of the inflamed dilated common duct incision exploration removal of the obstruction and drainage by the T tube is the procedure. For the narrow stricture sleeve resection and closure by end to end union leaving an opening in the anterior wall for the introduction of a T tube will usually be curative. When the stricture is diffuse it may be incised and a T tube inserted or the upper wide portion of the duct may be anastomosed to the duodenum or stomach by an end to side junction.

Single or multiple stones in the duct if not in the supraduodenal portion should if possible be milked back into the upper accessible portion of the duct where they can be cut down upon and removed. Once the stone is within the grasp of the fingers it should not be allowed to escape until removed. If the stone be allowed to slip into one of the branches of the hepatic duct its recovery will be difficult.

When the stone occupies the pancreatic portion especially the lower part it is usually situated in a localized dilatation or pocket and its removal is difficult. Only rarely can it be forced into the upper portion of the duct. Several methods to extricate it must be tried. A gall stone scoop may be passed down to it through an opening in the first portion of the duct and by manipulation the stone may be dislodged or broken and removed piecemeal. The stone may be pushed into the duodenum. When all

these means fail the duodenum should be mobilized turned toward the left and the duct incised over the stone. Following removal a T tube is inserted into the opening in the first portion of the duct in such a way that its lower horizontal limb extends down the duct into the duodenum.

A stone in the ampulla of Vater usually can be pushed into the duodenum or dislodged and removed above or broken up with the aid of the scoop in the duct and counter pressure on the duodenum with the tips of the fingers. But all of these may fail and then the only alternative is direct removal through a trans duodenal incision. We reserve this procedure as a last resort and only occasionally have been called upon to use it. It carries the risk of duodenal fistula. Crushing the stone in the duct is a dangerous procedure because of the likely injury to the walls.

In the presence of a new growth its location size and type usually malignant will guide the operator in deciding what is best to do.

Impassable or irremovable obstructions of the common duct are rarely encountered at primary operation on the biliary tract. If such be the case with an intact gall bladder and a patulous cystic duct then cholecysto gastrostomy is the operation of choice.

In conclusion it may be stated that any discussion of the surgery of the common duct must take into consideration its normal and pathological histology the fact that its lesions usually represent complications of disease of the gall bladder and therefore are preventable by timely surgery.

CLINICAL SURGERY

FROM BRONCHOSCOPIC AND SURGICAL CLINICS TEMPLE UNIVERSITY

THE SINGLE STAGE OPERATION FOR PULSION DIVERTICULUM OF THE OESOPHAGUS

W. WAYNE BABCOCK, M.D., F.A.C.S., AND CHEVALIER JACKSON, M.D., F.A.C.S., PHILADELPHIA

IN the Bronchoscopic Clinic more than 200 cases of diverticulum of the oesophagus have been studied and treated. The operative removal of the sac by multiple or single stage operation at the hands of various surgeons which in the earlier days gave a mortality of 10 per cent has with improvements in technique become very safe. Operative accidents such as removal of an excess of oesophageal tissue secondary stricture, the leaving of a portion of the sac with the resulting recurrence, injury of the recurrent nerve, oesophageal fistula, secondary hæmorrhage and wound infection have largely been eliminated by standardized methods. The need for a multiple stage operation which played an important part in the development of the operative treatment for diverticula has with present technical improvements largely disappeared.

A single stage operation may be done through a short transverse incision without division of any important structure with a period of disability lasting but a week or ten days and without the necessity for secondary bougienage or further treatment. Primary union without infection of the wound is usual; the sac is removed with a precision and accuracy that is difficult to accomplish with a stage operation and the scar is inconspicuous.

By the method of oesophagoscopy assistance devised by Dr. Jackson the sac is quickly and positively located during the operation; leakage from the diverticulum or the sac is prevented and a mandrin is provided upon which the opening in the hypopharynx or oesophagus may be accurately sutured without danger of constriction.

TECHNIQUE

Anæsthesia. The patient as a rule is partially narcotized by a retention enema containing avertin or by the use of other narcotics. Rigidity of the jaws is undesirable. The field of operation

in the neck is blocked and infiltrated in the conventional manner by freely injecting a 1 per cent solution of procaine containing suprarenin 1:60,000. By blocking of the third and fourth cervical nerves at the cervical spines satisfactory analgesia may be obtained.

As a guide for the rapid introduction of the oesophagoscope into the subdiverticular orifice a strong silk thread having three or four shot fastened at the end is swallowed two or three days before the time of operation. The operation as a rule is not attempted until the shot are shown by roentgenogram to be in the ileum.

The transverse skin incision about 7 centimeters long and preferably in a wrinkle line is carried from the midline of the neck at the level of the cricoid cartilage to about the middle of the left sternomastoid muscle. The skin, superficial fascia and platysma are divided transversely; the few small vessels encountered are ligated by catgut. Small retractors are now introduced. The left pretracheal muscles and underlying thyroid gland with adjacent trachea and recurrent nerve are retracted medially; the common vascular sheath of the carotid and the sternomastoid muscle laterally. A sufficient exposure may be obtained without division of the superior thyroid artery or the omohyoid muscle. The middle layer of the deep cervical fascia is separated medial to the carotid artery thus exposing the longus colli and the left wall of the oesophagus. This part of the operation which is nearly bloodless divides no important structures and may be quickly and easily done.

While the wall of the oesophagus is thus exposed the diverticulum may be difficult to identify. To overcome this difficulty the oesophagoscope is now introduced into the sac; any contained liquid is aspirated and particles of food are removed with forceps. The sac is pushed up into the wound where it gives off a deep red glow from

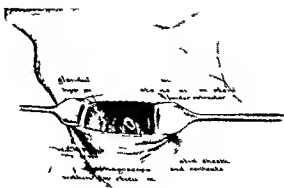


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the light in the end of the œsophagoscope. The ac is now grasped by soft viscera forceps and as the œsophagoscope is withdrawn into the pharynx the diverticulum which often is very thin and easily torn is carefully separated from the surrounding tissues. The end of the swallowed thread having been drawn through the œsophagoscope the instrument is now passed for a short distance down the œsophagus to serve as a guide in the removal of the sac and in the suture of the opening. The importance of this may be realized when it is understood that in a number of instances sections of the œsophageal wall have been resected in mistake for the diverticulum.

during the introduction of the suture the adjacent wound surfaces are protected with gauze moistened with 0.5 per cent hydrochloric acid in saline solution to prevent infection and stimulate early plastic adhesion. With constant aspiration through the œsophagoscope there is no escape of liquid from the œsophagus.

After traction sutures of fine black silk have been placed at the upper and lower margins of the neck of the diverticulum the sac is accurately cut away by sharp delicate (iris) scissors. With very fine curved eye or arterial needle the slit like opening is very accurately closed with a continuous suture of very fine black silk the fineness of an arterial suture being used. Great care is taken not to crush or traumatize the edges of the opening into the œsophagus and to make sure that the suture line is air and watertight and that there is no laceration or residual opening into the œsophagus or hypopharynx. The mucous margins are wiped with small cotton swabs moistened with 0.5 per cent tincture of iodine and

The first row of sutures is now inverted by a row of interrupted sutures of very fine silk or silver wire (size No. 35). If the silver wire is used it is tied not twisted and the ends are cut short. The hair like particles of the wire cause less irritation in a possibly contaminated field than other forms of suture material.

The tissues overlying the œsophagus are now further united by a third row consisting of interrupted sutures of fine silver wire or No. 000 chromic catgut. A very small split soft rubber tube drain (No. 10 to 12 F.) is introduced to the œsophagus below the line of suture. The platysma is united by interrupted sutures of No. 00 or 000 catgut the skin by horse hair.

The special features of the operation are a short transverse incision leaving good support and an inconspicuous scar, the very limited exposure or separation of tissue in the wound, the avoidance of traumatism to the walls of the œsophagus or any attempt to explore from the wound into the pharynx and the very delicate but accurate airtight and watertight closure of the diverticular opening. For best results we believe that transfixion and ligation of the neck of the diverticulum should be avoided.



Fig 3 From the light in the end of the Jackson oesophagoscope the diverticulum gives off a reddish glow in the depths of the wound enabling it to be immediately recognized and grasped by forceps

At the completion of the operation the swallowed thread is cut and permitted to pass through the intestine. A small duodenal tube is carried through the oesophagoscope into the stomach and brought out through one nostril. The tube is fastened by adhesive plaster to the side of the face or forehead and is used for feeding during the first 7 to 9 days after operation. After being returned to bed the patient is given a 2 liter enema containing 60 grams of glucose which under the narcosis is usually retained. Beginning 4 hours after the operation 60 cubic centimeters of 5 per cent dextrose solution is given through the duodenal tube every hour provided there is no nausea. At the end of 24 hours 120 cubic centimeters of light liquid food is given through the tube every 4 hours. This amount is gradually increased and the interval lengthened until the patient receives 180 to 240 cubic centimeters of nourishing liquids every 4 hours. Care is taken to pass sterile water through the tube after each feeding not only to cleanse the tube but to augment the patient's supply of fluid.

The small drain is removed at the end of 48 hours unless there is local reaction. The swallow

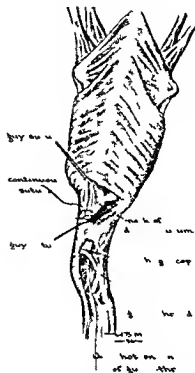


Fig 4 The diverticulum having been isolated from the surrounding tissues the oesophagoscope after aspirating the sac is withdrawn and is guided by a previously swallowed thread into the oesophagus proper. The neck of the sac is divided and the slit like opening in the hypopharynx very accurately closed by a continuous suture of fine black silk. Meanwhile the aspirating canal of the oesophagoscope keeps the field dry and free from pharyngeal secretion and also prevents undue constriction of the oesophagus in suturing so that the later passage of bougies is unnecessary.

ing of teaspoonful quantities of sterile water is tried after the sixth day. The duodenal tube is removed on the seventh to tenth day and thin liquids followed after 2 weeks by thicker liquids and very soft semi solid food such as thin gruels, junket, gelatin and soft eggs. Solid foods even if thoroughly masticated are not permitted until at least 6 weeks have elapsed.

It is obvious that the operation should not be used unless a very accurate closure of the oesophagus without undue trauma or gross contamination of the wound is possible. Should infection or leakage from the pharynx into the wound occur the wound should be freely opened, swabbed with tincture of iodine and adequately drained. Thus far however in our experience we have had no serious complication arise from this type of operation.

FROM THE DIVISION OF SURGERY THE MAYO CLINIC

TWO STAGE RESECTION FOR CARCINOMA OF THE RECTOSIGMOID AND RECTUM

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DIVISION OF SURGERY, THE MAYO CLINIC

THE ideal operation for removal of carcinoma of the rectum and rectosigmoid has not been devised because a radical extirpative measure cannot be accomplished satisfactorily with preservation of the sphincteric apparatus. Furthermore, problems associated with carcinoma of the rectosigmoid are not always comparable to those which present themselves in cases of carcinoma of the rectum and operative procedures aimed at removal of the one may not always be applicable to the other. The admirable prognosis in carcinoma of the rectum and rectosigmoid compared with that of other carcinomata of the gastro-intestinal tract counterbalanced although it is by an apparently unavoidable high mortality, urges continued efforts to reduce the death rate by improved technical maneuvers and standardized pre-operative and postoperative co-operative treatment by internist and surgeon. I do not believe that any one operation ever will be applicable to all types of carcinoma of the rectum and rectosigmoid for the reason that the patients present themelves at such varying stages of the disease and consequently in different physical states both as regards metastasis and local extension of the growth. However, it is my considered opinion that failure to apply radical extirpative procedures to a great many carcinomata in this situation is due largely to lack of courage and that such failure withholds the just due of many patients whom mature judgment would indicate have ability to withstand such a procedure. The operation which rid patients of the growth and at the same time avoids high hospital mortality, even though sacrifice of the splendid apparatus provided by nature is necessary, unquestionably will enhance favorably postoperative end results.

There are several types of operation with which one must be familiar in dealing with rectal and rectosigmoidal carcinomata in order to cope advantageously with the various problems which present themselves at exploration. Of these types I am convinced that a radical combined abdominoperineal operation in a single stage by which the local growth and the gland bearing tissue in immediate juxtaposition to it are extirpated

after the fashion of Miles or some modification which suits the individual surgeon's fancy is the most desirable one. However, it has been impossible in my experience to apply this type of procedure in a single stage as a routine because of the high immediate mortality which follows its use. One should not reduce the horizon of operability too materially because of partisanship to a single maneuver and that I think is the most important consideration. Last year in the clinic operability in cases of carcinoma of the rectum and sigmoid was 58 per cent, a very satisfactory operability, no doubt, and one which may not be materially increased in the immediate future. Yet in this 58 per cent of patients who were subjected to resection less than one third were judged proper risks for this type of operation. The patients who constituted risks graded 3 and 4 were treated by other types of maneuver.

To avoid the objections to many of the other proposed operative procedures and to preserve the desirable features of the single stage combined abdominoperineal procedure it has been my custom recently to perform this operation in two stages. Colostomy and exploration are carried out at the first stage, the bowel being divided and the rectal end being dropped back into the peritoneal cavity and the abdomen closed. A period of at least 6 weeks is allowed before the radical removal of the isolated segment is attempted. Removal is then accomplished by another combined maneuver. I have performed this operation in 3 consecutive cases with 1 death, an operative mortality of 4.3 per cent. With this encouragement I hope to extend the selection of cases more widely without unduly influencing the mortality, trusting that the end results will be more satisfactory because of the radical type of procedure performed. This operation can be carried out with lower mortality in a larger group of cases than can the single stage operation, and just as wide dissection of the tissues is accomplished in the immediate vicinity of the growth. The operation avoids the undesirable blind loop which is left behind in operations of the Lockhart-Mummery or the Jones type. Likewise it permits the making of the most satisfactory type of colos-

tomy a single barreled one through a small stab wound in the left flank. A colostomy of this type in my experience is much more readily controlled than is any other type and is much more easily made.

The acceptance of colostomy as a routine was one of the great steps forward in surgical treatment of carcinoma of the rectum and rectosigmoid and yet all procedures aimed at its performance leave something to be desired in the way of control. Satisfactory handling of colostomy is in direct proportion to the simplicity of its accomplishment the simpler it is made the more easily it is handled. Any simply performed colostomy particularly if it is a single barreled one is easily controlled as long as the fecal current is formed and no colostomy yet devised is controllable or tolerable if the content of the bowel is liquid.

After the performance of the colostomy as the first stage of the combined abdominoperineal operation the patients have returned home for a period of 6 weeks or longer to gain weight and strength. They have returned for the resection in an infinitely superior physical state with the local infection around the growth markedly reduced by irrigations through a rectal tube. Another point to which I would call attention in this particular operation is its especial applicability to rectosigmoidal growths. I do not believe that carcinomata of the rectosigmoid can in any way be satisfactorily treated by colostomy and posterior resection of the growth at a subsequent stage. This to my mind constitutes local extirpation of the growth which has numerous well known objections. The rectosigmoid notoriously difficult of access is the site of a great many carcinomata probably of more than the ampullary portion of the rectum and the nodal drainage therefrom particularly that into the mesentery of the sigmoid makes it necessary to remove more mesentery and adjacent tissue than is possible by a posterior type of excision. It is for growths in this situation particularly that the operation described is decidedly advantageous.

TECHNIQUE

In The Mayo Clinic the diagnosis of carcinomata of the rectum and rectosigmoid and as far up in the sigmoid as the juncture of the lower and middle thirds is always made by proctoscopic examination and not by roentgenography. It is the custom when a growth in this portion of the bowel is discovered to take a specimen for biopsy with a cutting knife and immediately with a cautery to touch the spot from which the specimen

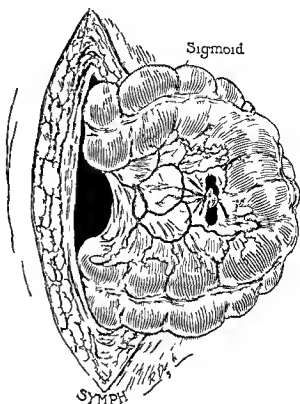


FIG. 1. Ligation of single vessel in mesentery of sigmoid close to the bowel.

has been removed. Although numerous objections formerly have been raised to biopsy of malignant growths I believe that proof of injury done or of spread of carcinomatous cells by the method mentioned is totally lacking and that the objection is based purely on opinion rather than on scientific conclusion. After adequate preoperative preparation of the patient which aims mainly at decompression of the bowel by rectal irrigation enemas and judicious purgation as well as at rehabilitation of the patient when that is indicated exploration of the abdomen is carried out through a low median line incision. Sistrunk called attention to the advantages of this incision and with increasing use I have found it very desirable. Exploration is made in routine manner from the superior portion of the abdomen down to the pelvis the growth being touched last. Then lightly and gingerly the mobility of the growth and the chances of resecting it are determined. Beginning at the liver as quickly as possible the surgeon explores the surface of the two lobes for nodules down the aorta feeling the nodes around the pancreas and those on each side of the aorta down into the bifurcation of the common iliac vessels and then down into the pelvis. Lastly the growth is palpated and if it is deemed resectable a convenient portion of the

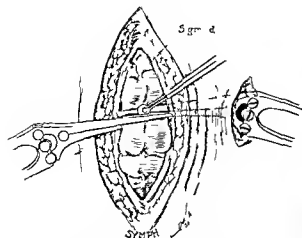


Fig 1 Sigmoid loop with Payr clamp applied to the upper end of the loop.

sigmoid that is the highest point in the loop is selected for the colostomy. The mesentery close to the bowel is divided (Fig 1) and only sufficiently widely to permit the proximal end to be drawn out through a stab wound and the distal end to be dropped back. It is always possible to be sure of the blood supply to both ends and any of the essential arteries are not divided. The superior hemorrhoidal artery and its anastomosis with the necessary sigmoidal arches are preserved under the eye. The rectal end of the bowel is turned in and the other end is brought out through a stab wound in the flank. To avoid false motion it has been found desirable to make the stab wound in the flank as soon as the blood supply to the bowel has been tied off and to push through this wound a Payr clamp which clasps the upper end of the bowel at the properly selected spot (Fig 2). With another clamp approximated to this but applied in opposite direction the bowel is cut across and the proximal end is drawn out while the distal end is turned in as has been described (Fig 3). The clamp obstructs the proximal end completely and is left on for 48 to 60 hours. Sutures are not put in the bowel to bind the peritoneum to it. In making the stab wound it is advantageous to cut down through the muscles of the abdominal wall. The incision is only about 5 centimeters long and a smaller incision is made in the peritoneum so that the peritoneum will hug the bowel closely. A piece of gauze going down to the peritoneum is wrapped around the end; the clamp is held on the abdomen by tape after the median line incision is closed and is left to be opened at the selected time (Fig 4). Sutures

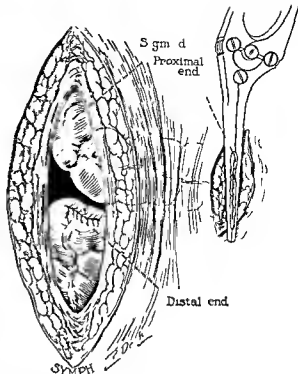


Fig 3 After the sigmoid loop has been divided, the proximal end is drawn out through a stab wound and the distal end is dropped back.

are not used in colostomy to attach the loop to the peritoneum or to any other layer of the abdominal wall. For a long time I have not attempted to assist nature in the healing process of joining peritoneum to peritoneum and do not regret omitting the sutures in this type of operation. The peritoneum is snug around the bowel and heals readily in 48 hours or at most in 60 hours and there is no disadvantageous small puncture into the bowel by a needle which may result either in leakage back into the peritoneal cavity and contamination or in a small annoying fistula beside the colostomy opening. It is questionable whether the mortality is higher in colostomy of this type than in the ordinary loop colostomy in which there is no manipulation. My mortality rate in ordinary colostomy is 3.5 per cent in operable cases and twice that high in cases which are considered inoperable but in which nevertheless exploration is performed. The clamp is taken off at the end of 60 hours or more as is necessary. I have found it better to have the patient wait at least 6 weeks and perhaps longer before returning for the secondary resection. This I believe has been a distinctly important factor in

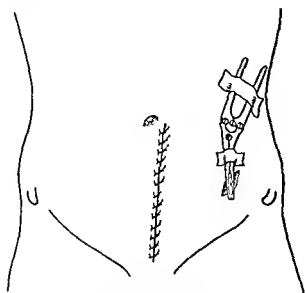


Fig 4 Position of abdominal wounds and of clamp holding proximal portion of sigmoid

the successful accomplishment of this procedure. The objection is raised that the carcinoma may metastasize in this time but I question if it is valid when this possibility is compared to the advantage of lowering operative mortality in a larger group of cases. When the patient returns the resection is done at first posteriorly but finally by another abdominal incision.

This posterior type of attack and partial mobilization permits extensive dissection of the pelvis up to the peritoneum. Thus it is possible to clean out the hollow of the sacrum and ischiorectal fossa thus sacrificing the levator ani muscle and clearing away the gland bearing tissues around the prostate gland and seminal vesicles in the male and from the posterior vaginal wall, cervix and broad ligaments in the female. With the patient face downward on the table with the hips elevated and the anus closed with a pursestring suture two concave incisions are made which extend from a little above the sacrococcygeal joint around to the center of the perineum (Fig 5). These incisions are carried downward first on one side and then on the other as much fat and gland bearing tissue as is warranted being taken away down to the levator ani muscle which is removed as high toward its bony attachment as possible (Fig 6). I always sacrifice the coccyx but prefer to disarticulate it from the sacrum rather than to chisel off a piece of the sacrum because this disarticulation is less likely to be followed by osteomyelitis and other unpleasant sequelæ. After the dissection has been carried out in this manner and the fascia propria has been divided opposite the sacrococcygeal articu-

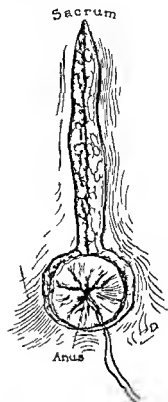


Fig 5 Incision in skin over the sacrum and encircling the anus

lation the hand is thrust into the hollow of the sacrum and by blunt dissection all the tissues are separated from this bone. When the lateral dissection has been completed up to the peritoneum but without its being opened the entire rectum is encased in a rubber glove which is tied tightly around the cuff (Fig 7). The segment is dropped back into the hollow of the sacrum and the posterior wound is closed. The patient is then turned on his back and the anterior part of the dissection is carried out. Through a low incision in the median line the abdomen is opened and the pelvis is exposed and packed off from the remainder of the abdominal cavity by wet gauze sponges. The peritoneum over the inferior mesenteric vessels is incised after identification of the left ureter (Fig 8). This runs rather close to the vessels but the right ureter is far distant and is never in danger of being ligated with them. When the peritoneum is opened over the vessels they are booked up over a finger close to their origin and doubly ligated and divided (Fig 9). With the exception of the middle sacral artery this is practically all of the blood supply to the rectum and sacral region but the middle sacral artery which is the terminal branch of the abdominal aorta frequently will require a separate ligature. The peritoneum is incised forward, toward the base of the

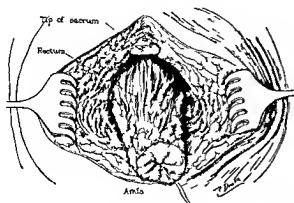


Fig 6 Excision extended showing partial mobilization of rectum Coccyx removed

bladder on both sides and the bladder is separated from the rectum. The gland bearing tissue is wiped mesially from both sides with gauze and the entire segment is lifted out through the abdomen (Fig 10). The large cavity thus opened must necessarily heal by granulation tissue and no attempt is made to close it without drainage. After peritonization of the pelvis that is after making a new pelvic floor the abdomen is quickly closed. I have never had much difficulty in peritonizing the pelvis. If the patient is a woman there is no

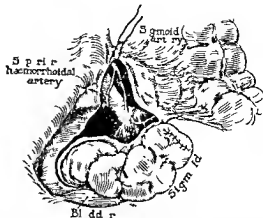


Fig 8 Ligation of blood supply to sigmoid and rectum

difficulty because of the utilizable broad ligaments and the uterus. If a male there is almost as little trouble. If one uses the peritoneum over the bladder and mobilizes the lateral portion of the peritoneum satisfactorily.

The abdominal part of the operation may be accomplished quickly and is bloodless after ligation of the inferior mesenteric vessels. After the wound is closed two of the lower sutures in the posterior wound are removed and a small gauze pack is put into the bellow of the sacrum for drainage. The entire second stage of the operation is neither difficult nor time consuming and utilizes the most satisfactory principles of the radical procedure with lowering of the primary mortality as it is done in two stages instead of one.

The postoperative convalescence in my cases has been similar to that in cases in which posterior resection has followed colostomy and usually the wound has healed completely in about 3 months. Sometimes it takes longer but when once healed there is no disadvantageous irritating and undesirable mucous fistula from a blind loop. A single barreled satisfactory colostomy is established and the radical type of attack on carcinoma in this situation has been carried out.

I would emphasize that the preliminary preparation of these patients the proper decompression of the colon whenever it is possible without a drainage procedure and the permitting of long periods to elapse between stages seem to me to be the most valuable adjuncts toward the success of any radical graded procedure. That there are disadvantages must be admitted for any operation whereby the abdomen must be invaded twice within a period of a few months is not free from an opening for criticism. Yet if satisfactory operative mortality can be maintained without

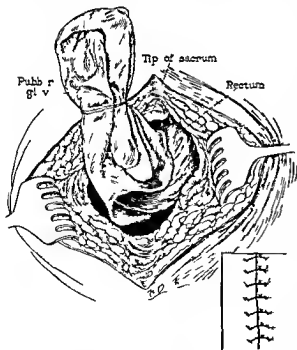


Fig 7 Completely mobilized rectum encased in rubber glove. Insert shows wound closed after segment is dropped back into hollow of sacrum

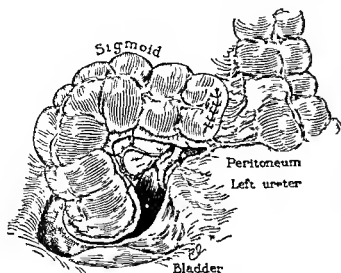


Fig 9 Division of peritoneum for mobilization of sigmoid and exposure of left ureter

the sacrifice of any steps which should increase rather than diminish the horizon of operability I believe the procedure merits consideration and trial

Appended is an epitome of the case which terminated fatally in this series of 23 consecutive cases. In the series there were only 5 cases which I deemed of sufficient gravity from one standpoint or another to justify refusal of this radical type of operation and in which colostomy and subsequent posterior resection were performed. This confirms the assertion I believe that with increasing use one finds a wider scope for the more radical type of removal.

A man aged 69 years whose past history was essentially negative was admitted to the clinic with a history of rectal bleeding and diarrhea that dated from a hemorrhoidectomy 10 months previously. Also dating from this operation was evidence of diabetes mellitus which on the patient's admission to the clinic was satisfactorily controlled by diet. The patient appeared to be in a state of general debility. He had lost 15 pounds in weight and laboratory examination disclosed evidence of moderate secondary anemia. Marked general arteriosclerosis, myocardial degeneration and mitral insufficiency (compensated) were noted. The prostate gland was moderately enlarged and mild urinary symptoms were present. Proctoscopic examination disclosed adenocarcinoma graded 2 of the rectosigmoid; the growth was fixed posteriorly and was causing moderate obstruction.

After a period of hospitalization during which rehabilitation measures were instituted and intraperitoneal vaccine was administered exploration was carried out under spinal anesthesia. Metastasis could not be made out

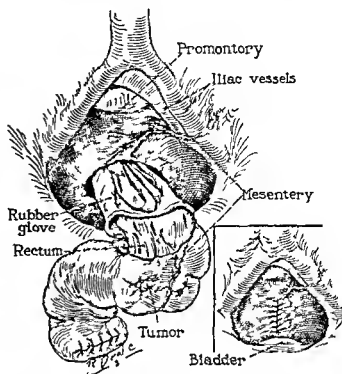


Fig 10 Anterior approach. Entire rectum being lifted out of hollow of sacrum. Peritonization of pelvis completed

The sigmoid was found to be diffusely studded with diverticula and a little above the rectosigmoid juncture was a large tumefaction. A single-barreled colostomy was performed as the first stage of abdominoperineal resection of the rectum. Within 24 hours there were signs of impending diabetic coma which required the administration of large doses of insulin. Aside from this complication the patient recovered satisfactorily and after 5 weeks was able to control the diabetes by diet alone. Three months at home brought about general improvement in his condition. In spite of the grave risk which further operation would entail the patient and his relatives were insistent that the rectal growth be removed. Following its removal as the second stage of combined abdominoperineal operation and until the patient's death 70 hours later the total urinary output was only 450 cubic centimeters. Signs of uremia appeared early and became progressively more intense. There was no evidence of peritonitis.

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FURTHER OBSERVATIONS ON THE USE OF CASTOR OIL QUININE AND PITUITARY EXTRACT IN THE INDUCTION OF LABOR

AN ANALYSIS BASED ON THE STUDY OF THREE HUNDRED AND TWENTY CONSECUTIVE CASES FROM PRIVATE PRACTICE¹

ALBERT MATHIEU M.D. F.A.C.S. AND MARTIN S. SICHEL M.D. PORTLAND OREGON

IN February 1927 in the *American Journal of Obstetrics and Gynecology*, one of us (Mathieu) reported observations on 91 cases in which castor oil quinine and pituitary extract were used for the purpose of inducing labor. At that time it was stated:

Much of the advantage of prenatal care is lost if one allows the head of the fetus by sheer growth to reach a stage of marked disproportion with the pelvis of the mother who carries it when induction might have avoided this complication.

Women with histories of rapid or precipitate labors or with thin dilated cervixes at term should not be allowed to suffer precipitate labor while on the way to the hospital. Nor should the mother with toxemia progressive in spite of treatment be further endangered by delay. The woman at term who is suffering distress and discomfort due to pain, pressure, insomnia and nervous anxiety should not be permitted to reach the stage of exhaustion because one wishes to let Nature take her course. Nor is it good obstetrics to allow a woman near term whose membranes are ruptured to go longer than 24 hours without inducing labor.

In that paper was described a modification of the dosage used in the method of Watson where by the main objectionable feature of the Watson method was overcome by reducing the dose of pituitary extract to 3 minims for each injection. Among other data this series of carefully analyzed cases revealed the following facts: There were 3 failures—a percentage of 3.3; the morbidity among the mothers was 4.4 per cent; there were no harmful effects seen from the use of these drugs in induction and there were recorded no maternal or fetal deaths either early or late.

The present paper has to do with an analysis of 320 consecutive induction cases all taken from the private practice of one of us (Mathieu) and includes all the patients in whom labor was induced during the 9 years from 1922 to December 1930. In the entire series there were 155 primiparæ and 167 multiparæ. All of the patients were of the white race.

INDICATIONS

The indications for induction were as follows:

| | Case |
|--------------------------------------|------|
| Postmaturity | 6 |
| Postmaturity with | |
| Large baby | 31 |
| Premature rupture of membranes | 13 |
| Distress and discomfort | 1 |
| Fear of precipitate labor | 5 |
| Multiple fibroids | |
| Maturity with | |
| Large baby | 43 |
| Distress and discomfort | 30 |
| Contracted pelvic outlet | 9 |
| Pain | 16 |
| Fear of precipitate labor | 4 |
| Former dead baby | 3 |
| Prematurity with | |
| Toxemia of pregnancy | 34 |
| Premature rupture of membranes | 6 |
| Birth preparation | 7 |
| Death of fetus before onset of labor | 5 |
| Contracted pelvic outlet | 4 |
| Eclampsia | 3 |
| Chronic pulmonary tuberculosis | 3 |
| Placenta prævia | |
| Blotchy lips | 1 |

METHOD

The method used is practically identical with the one presented in the early report 3 minims of pituitary extract being used at each injection.

The method is as follows: In the hospital the patient is given 2 ounces of castor oil and 10 grains of quinine sulphate and exactly 2 hours afterward a hot soap-suds enema. As the enema is about to be expelled 3 minims of pituitary extract are given hypodermically. This same dose of pituitary extract is repeated every 30 minutes until labor starts and no longer. From then on the labor is conducted as though the onset has been normal. Failure is admitted and the procedure stopped if 8 hours pass without labor being started or if there is absolutely no sign of any effect toward induction or if the continued use of the injections is too trying to the mother. In such cases the procedure is stopped the mother is given an hypnotic or sedative and after 24 or 48 hours the induction is again attempted.

Over 2 years ago the quinine sulphate dosage was cut from 10 grains to 5 grains. The last 120 inductions were made without any quinine sulphate whatever. We feel that the induction can be done without the quinine, and since several authors have reported intra uterine deaths which they think were caused by quinine we feel that it is better to do without it.

All of the inductions have been done by two nurses who are highly specialized in these matters. The method is as follows. Two ounces of castor oil is given early in the morning preferably at 6 o'clock, exactly 2 hours later a hot soapuds enema is given. In certain cases labor will commence at this stage and it is unnecessary to proceed further. In the majority of cases however as the enema is being expelled 3 minims of pituitary extract is given hypodermically; this is repeated every half hour until labor commences or until 15 injections have been given without effect. During the entire induction the gravida should lie flat on her back with only one pillow for the head. Failures might follow if she is allowed to walk about. In the event of failure a sedative is given and stimulation is started again within 24 or 48 hours with the same routine. *The injections are stopped as soon as labor begins.* Nasal stimulation with one cubic centimeter of pituitary extract on cotton applied to the mucous membrane of the nose has been used instead of the hypodermic injections.

Thirty nine cases (12.2 per cent) in this series were successfully induced with castor oil, quinine and the hot enema. The remainder necessitated hypodermic administration of pituitary extract. In 4 cases induction with nasal applications of pituitary extract using the method of Hofbauer was successful. In four cases thymophysin was used. We feel that thymophysin has the same action as pituitary extract and notwithstanding many published reports we feel that it has added nothing to our armamentarium. Incidentally, we have used thymophysin for inertia in the second stage of labor after having read the reports of Jarcho and others. We have learned from clinical experience what Rucker found with the bag and manometer namely that thymophysin does not act differently than pituitary extract and that the same contra indications should prevail against its use as prevail against the use of pituitary extract.

SUCCESSSES

There were 309 successful inductions (96.6 per cent) in the series. The following analysis shows the number of attempts at induction necessary before success was attained.

| Number of attempts | Cases |
|--------------------|-------|
| One | 216 |
| Two | 6 |
| Three | 24 |
| Four | 4 |
| Five | 3 |

A word of explanation seems necessary regarding those cases in which several trials at induction were made before the induction was successful. We have always been extremely careful in trying to make the induction safe particularly in an effort to avoid an injection of pituitary extract after labor had apparently started. In not a few cases we have purposely stopped the injections when there was any uncertainty as to whether or not the patient was actually in labor—accepting a failure rather than assuming a risk.

Consider the nervous and anxious patient in the last fortnight of her pregnancy whose uterus seems to be on the verge of evacuating its contents. Every evening in this period when the clothes are removed contractions of the uterus start and continue in the regular manner for several hours ceasing when the patient falls asleep. We cannot state whether this is a nervous phenomenon or whether it is actually a forerunner of true labor but we know from clinical experience that this type of patient presents the most difficulties. During the induction regular contractions of the uterus start after a few injections of pituitary extract only to stop entirely several hours after the administration has been stopped. As previously stated this type of patient has given us the most trouble. In our attempts to be absolutely safe we have preferred discontinuing the attempted induction, giving the patient a sedative and a good night's sleep and renewing the attempt on the following day.

The average number of injections for 145 primiparae in all of whom the induction was successful was 6.7. Four of these cases had nasal applications of pituitary extract by the method of Hofbauer. When nasal applications of pituitary extract were used there were no hypodermic injections given.

The average number of injections for 164 multiparae in whom the inductions were successful was 6.0. Of the failures in the series that were later followed by successes the average number of injections given the primiparae were 11.4 and the multiparae 9.1.

The highest number of injections necessary to insure success in a primipara was 16 and in a multipara 14. The lowest number given in the failures was 3 in a primipara and 4 in a multipara. The average length of labor of the successful

primiparæ was 12 1 hours. The 2 longest labors were 92 5 and 52 hours. In these 2 longest labors the real length of the labor is indefinite because in the first half of the labors the uterine contractions were more or less irregular with lapses of some hours without contractions. The shortest labor was 1 hour and 45 minutes. The average length of labor in the successful multiparæ was 4 5 hours. The longest labor was 1, hours and the shortest 45 minutes.

With the head deeply engaged the cervix effaced and the external os admitting a finger the chances of a successful induction were greater than in those cases in which the head was floating and the cervix was not effaced. This was noted alike in primiparæ and multiparæ. In many cases necessitating several trials at induction the head was floating at the first attempt by the second or third attempt the head had become deeply engaged and success was easily obtained. With both engagement and effacement present the number of hypodermic injections necessary to induce labor was lessened and the total length of labor was slightly shortened.

In the 29 cases of spontaneous premature rupture of the membranes and in a few others in which the membranes were ruptured artificially because of some urgency the induction was one hundred per cent effective on the first trial. We hope it will be noted that in the entire series of three hundred and twenty attempted inductions there was not one single case of prolapse of the cord, the one serious objection to induction by bag or bougie.

The following tabulations illustrate facts

| | V | tex | ng | g | d | ly | N | t | s | ged |
|---------------------------------|----|-----|-----|---|---|----|-----|---|---|-----|
| | | ng | s | d | | | | | | |
| Successes | 23 | | | | | | 70 | | | |
| Failures | 6 | | | | | | 5 | | | |
| Hours of labor | 7 | 5 | | | | | 9 | 8 | | |
| Number of hypodermic injections | | | | | | | | | | |
| Unsuccessful trials | 9 | 5 | | | | | 12 | | | |
| Successful trials | 4 | 0 | | | | | 5 | 8 | | |
| Technical mistake—6 cases | | | | | | | | | | |
| Not specified—3 cases | | | | | | | | | | |
| | | Ce | vis | d | | | Cer | e | r | d |
| | | | | | | | | | | |
| Successes | 37 | | | | | | 08 | | | |
| Failure | 5 | | | | | | 6 | | | |
| Hours of labor | 7 | 7 | | | | | 13 | 1 | | |
| Number of hypodermic injections | | | | | | | | | | |
| Unsuccessful trials | 6 | | | | | | 4 | | | |
| Successful trials | 4 | 4 | | | | | 8 | 0 | | |
| Not specified—4 cases | | | | | | | | | | |

The average weight of the living babies was 3 558 grams. Ninety four babies weighed over 3 800 grams and 5 weighed under 2 200 grams. The 2 largest babies weighed 4 810 and 5 586 grams, the 2 smallest 1 370 and 1 345 grams.

There were eleven failures following attempts at induction with castor oil, quinine and pituitary extract.

MORBIDITY

There were 23 cases of morbidity (patients who had a rise of temperature up to 100 4 degrees on two different days excluding the day of delivery) 7 2 per cent for the entire series. In no case did it appear that the morbidity was directly due to the induction of labor. The following table shows the cause of the morbidity.

| C | Ca | use | of | dy | C |
|---|--------|----------|----------|-----|-------------|
| 6 | Py | litis | | | |
| 5 | Infect | d | perineum | | |
| 5 | M | stitis | | | |
| 3 | I | blebitis | | | |
| 1 | Pleu | nsy | | | |
| | Pneu | m | a | | |
| 1 | Infect | d | p | b | otomy wound |
| 1 | Hæm | rrhage | postpa | tum | |

MORTALITY

There were no maternal deaths. There were no fetal deaths directly due to the method of induction. There were 9 fetal deaths in the series 5 of which were macerated fetuses dead before the induction was started and the inductions were done because it was obvious the babies were dead. There were 2 stillbirths. One of these babies died in utero during an eclamptic convulsion of the mother who had no prenatal care and who was an emergency case. The other died from strangulation of the cord just prior to delivery due to a short cord wrapped tightly twice about the baby's neck. There were no neonatal deaths both due to congenital anomalies.

CLASSIFICATION OF FETAL DEATHS

| | | |
|--|---|----|
| Mac | erated fetuses at term | |
| Toxæmia | | 1 |
| True knot in d | | 1 |
| Macerated fetus at 8 month (t xæmia) | | 1 |
| Macerated fetus at 5 months (mother had multiple uterine fibroids) | | 1 |
| Stillbirths | | |
| Dead during c d mpt c c nval o | | 1 |
| Strangulation f c d | | 1 |
| Neonatal death | | |
| D d fourth day—congenital occlusion of bil ducts and patent f rane | | 1 |
| D d twelfth day—hydrocephalus | | 1 |
| | Per | 1 |
| Total fetal mortality | | 28 |
| Stillbirth mortality incl d ng macerated fet s | | 23 |
| Neonatal mortality | | 6 |
| Corrected total fetal mortality | liminating macerated fetuses and deaths due to congenital defects | 06 |
| The details of the failures will be found in the appendix. | | |

METHOD OF DELIVERY

The method of delivery following induction was as follows

| Type of delivery | Cases |
|-------------------------------|-------|
| Forceps delivery | |
| Mid forceps | 65 |
| Low forceps | 119 |
| Control forceps | 63 |
| Total | 247 |
| Spontaneous delivery | 49 |
| Version and breech extraction | 12 |
| Breech extraction | 7 |
| Cesarean section | 1 |
| Mid forceps and pubiotomy | 1 |
| Twin delivery | 3 |
| Mid forceps | 2 |
| Low forceps | 3 |
| Breech extraction | 1 |

SUMMARY AND CONCLUSIONS

1 In a series of 320 cases in private practice the castor oil quinine and pituitary extract method of induction of labor was successful in 96.6 per cent of the cases

2 Induction caused no increase in the maternal mortality, the maternal morbidity, fetal mortality or fetal morbidity

3 Induction was most successful when the head was engaged and the cervix effaced

4 Induction was apparently not responsible for the occurrence of any pathological conditions during labor, delivery or the puerperium.

5 In the last 10 inductions quinine was not used and the results were apparently not affected by its omission.

In this series of 320 cases there appeared no basis for the fear some hold that the use of pituitary extract in the induction of labor causes separation of the placenta.

In this number of cases which on close analysis seem to include most of those cases that promise trouble (the toxæmias eclampsias large babies contracted pelvic outlets etc.) the maternal morbidity and the fetal mortality were surprisingly low in fact, it appears to us that in this series the induction saved much maternal morbidity and several fetal lives.

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THE ROENTGEN-RAYS AND RADIUM IN THE DIAGNOSIS AND TREATMENT OF CARCINOMA OF THE BLADDER¹

G E PFAHLER M D Sc D M RE (CAME) PHILADELPHIA
F i s s i o n R a d i o l o g y G d t e S c h o o l I M d U n i v e r s i t y P e n n s y l v a

THE injection of air into the bladder for the demonstration of tumors has been used by me for diagnosis and for teaching since 1910 and the technique was discussed by me at various meetings of roentgenologists. Realizing that this procedure was not in general use I presented a formal paper upon this subject before the Philadelphia Roentgen Society on May 8 1919. Since then this method has been used more and more but even now is I believe much neglected. This modified roentgen method of examining the bladder has not been routinely used in the past evidently because of the great skill that has been developed by the expert cystoscopist. In my opinion additional information will be obtained in most cases if a pneumocystographic study is combined with the cystoscopic examination but there are many cases in which a satisfactory cystoscopic examination is not practical for the following reasons: (1) because of the severe pain which generally accompanies these cystoscopic examinations unless under a general anesthetic (2) because of inability to pass the cystoscope (3) because of severe hemorrhage which clouds the field (4) because of decided objection on the part of the patient (5) because an expert cystoscopist may not be at hand.

TECHNIQUE FOR PNEUMOCYSTOGRAMS

It is my custom to make an anterior and a posterior film of the bladder region before any air is injected. This preliminary film will demonstrate any opaque calculus that may be present and will particularly demonstrate any localized collection of gas in the rectum or colon which may be confusing in the interpretation of the subsequent pneumocystograms. The urethral orifice is then cleansed and all of the usual precautions and preparations are made which are necessary for passing a soft rubber catheter. A sterile soft rubber catheter of the largest size that will pass without pain or inconvenience is then introduced. If there is an obstruction from a prominent middle lobe of the prostate one may use a prostatic catheter. Any residual urine should be withdrawn for a soft tumor surrounded by fluid may not be demonstrated. Occasionally one does not succeed in removing all of the urine but if air is injected and one examines the patient anteriorly

and posteriorly there will be one of these two positions in which the tumor will be surrounded by air as I shall demonstrate to you (Figs 1 2 and 3).

After the urine has been withdrawn an antomizer bulb is attached to the catheter by means of a tapering glass connecting rod and then by gentle compression with the thumb and index finger air is pumped into the bladder until the patient complains of bladder distention or until one can feel the distention of the bladder by palpation or outline it by percussion. A pair of hemostatic forceps is clamped upon the catheter and both of these are strapped to the thigh by means of adhesive plaster all of which is prepared in advance so as to minimize the delay and distress from bladder distention. To economize time all of these procedures are taken with the patient on the Potter-Bucky diaphragm with tube and film in position so as to make the exposures with the least possible delay.

If the injections are made slowly and due attention is paid to the patient's complaint of pressure I believe no harm can result. I know of no instance of an air embolism developing and can see no reason for it since pneumopyelography has been used with success. Surely if the kidney pelvis can be distended with air one need not fear the distention of the bladder.

One or more 8 inch by 10 inch films are made posteriorly directing the rays in line with the axis of the pelvis and then one or more films are made anteriorly the patient being carefully turned upon the abdomen and the rays directed obliquely anteriorly and upward. I usually make several films with some variation in the exposure in each position.

Generally the anterior view will give most information but both views are essential. After the examination has been finished the patient is turned to the supine position and by the release of the clamp the air is quickly expelled. A little pressure over the bladder will be helpful. If by chance the catheter comes out of the bladder a sterile one should be inserted and the air allowed to escape. It is generally advisable to compress the bladder to expel all of the air.

After several hundred such examinations I have not had any serious objection on the part of

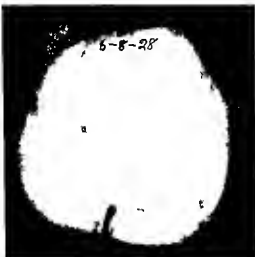


Fig 1



Fig 2



Fig 3

Fig 1 No evidence of the bladder tumor was noticeable June 8 1928 because it was surrounded by 8 ounces of fluid which we did not succeed in removing preceding the pneumocystogram made with a posterior film Case 1

Fig 2 We then turned the patient in the prone position and this pneumocystogram shows very clearly the two tumors of the bladder The large one from which the specimen had been removed and the other smaller one indicated by arrows June 8 1928

Fig 3 Another anterior film made in the prone position shows complete disappearance of the tumor May 8 1929 and the patient has remained free from symptoms and has been found free from disease also cystoscopically by Dr Haines Briefly the history is as follows

Mr A T G T aged 49 years was referred on May 21 1925 by Dr Francis J Dever of Bethlehem Pa on account of leucoplakia involving the glans penis This was found later to be carcinoma and was treated by electrocoagulation and radium applications with temporary cure A recurrence however developed and on June 2 1930 I removed the glans penis and sulcus completely by electro

coagulation with no evidence of recurrence and complete comfort and freedom to date

On June 8 1928 he returned to us with the history of hemorrhage from the bladder and cystoscopic examination by Dr Wilbur Haines showed evidence of carcinoma within the bladder We then obtained the history that he had been sent to Dr Estes of Bethlehem 3 years previously on account of bleeding from the bladder On June 8 1928 Dr Haines found a tumor about the size of an English walnut and removed a specimen for microscopic examination This was reported by Dr Eugene Case as papillary carcinoma of the bladder Dr Haines did two subsequent destructions on this tumor mass and he received from us the following X ray treatment

He was given high voltage X ray treatment through four fields 2 anteriorly and 2 posteriorly cross firing upon the bladder giving a 100 per cent through each area between June 15 and July 10 He has had a second course of precautionary treatment and re examination of the bladder by pneumocystogram on May 8 1929 which showed the tumor entirely gone

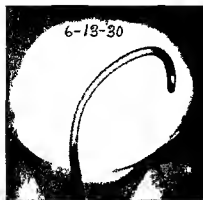
the patient and no damaging effect One patient developed a chill shortly after this examination from which he promptly recovered but it is well known that a chill may occasionally follow any catheterization

TUMORS DEMONSTRATED

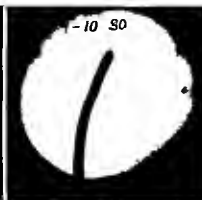
By this means I have succeeded in demonstrating several hundred bladder tumors and so far as I know have failed to demonstrate only one Tumors of the size of a thimble to a size that fills the entire bladder have been shown They have been demonstrated in all parts of the bladder One can demonstrate the size position outline and degree of infiltration One really demonstrates not only the filling defect but the flexibility or lack of distensibility of the bladder wall The serious sign of malignant disease is infiltration and the part of the bladder wall which is infiltrated by a malignant growth cannot be distended This gives information which I believe



Fig 4 Showing tumor mass size of a goose egg Mr D S aged 55 years referred by Dr W Mackinney February 2 1921 frequent voiding of bloody urine for 1 year Tumor mass destroyed by electrocoagulation through a suprapubic cystostomy by Dr Mackinney and myself and 13 10 mill radium needles introduced into base of tumor for 8 hours half anteriorly and half posteriorly making 150 per cent in tumor area during a period of 4 months He lived 9 years and died October 1930 of intercurrent disease Case 2



Fg 5



F 6



F 7

Fg 5 C 3 Sh th t m m with b
pp m tly 5 t m t d m t J n 3 93
s F 6 Th st m m w d dt b t th
t g l sz by S pt mb 93
Fg 7 T m h m pl tly d p l ed J ry 6
03 dth p t t f f m lly m t m Br fly th
h t ry f l w M G W S g d ssy f d
by D J m M A d J 3 93 dt l t t
th m pl t d pp f th b d b d g l
n d l t m b t th k f th bl dd wh h h w d
p g d t d d pp ra d X y

treatme t g n with h h l t g X y (k l l t
m l l m e t e opp f i l t t 4 t m t e d t a c)
th gh th e f i l d f t m t t l y d t w
th h t b i a t c n t h d u r t d t t h t m
g g p p u m t e l y 5 p t f n e r y t m
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m t g n b d c t e d t h p t t h d o n N m
b 7 93 t h f m f d m p k e t d t
th v g m l l m f d m f l t d t h h
m l l m t f p l t m t d t f t m t d
e t d t w d t h t m f m p t l y t h t m b
n p t t d f p d f 4 h r s

cannot be obtained otherwise without operation and will be useful in determining the method of treatment to be chosen.

One cannot always decide by pneumocystography whether a growth is malignant or not but if the tumor is large with a broad infiltrating base and occurs in a patient past the age of 35 years one can be reasonably certain of the tumor being malignant. If the tumor is small in size or multiple pedunculated and not infiltrating (bladder distending smoothly and evenly in all directions)

then we may assume that it is benign. A cystoscopic biopsy is necessary to make an exact diagnosis but this is subject to error and depends upon the portion of the tumor taken. Pneumocystography is in no sense intended to replace cystoscopy.

All growths of the bladder are potentially malignant and should be removed either by destruction by electrocoagulation by the thermocautery by excision by radium applications by means of roentgentherapy or by some combination of these methods. In all cases the disease should be recognized as early as possible and treated thoroughly from the beginning. This simple procedure will be useful in recognizing early carcinoma but cannot be depended upon as final in the elimination of early carcinoma or of a small tumor in the bladder.

IRRADIATION TREATMENT

Irradiation may be applied in various ways but no methods have yet produced enough cures to make us enthusiastic nor to make us feel satisfied. This dissatisfaction also applies to surgical excision. The dissatisfaction from surgery is indicated by such records as that of Lower who reports a series of 22 cases of bladder tumors of which 108 were malignant. 81 of these malignant cases were operated upon with an operative mortality of 98 per cent and a death rate within a



F 8 Th h d w f th t m mas n th p
te film m d p p t t Th h d w l
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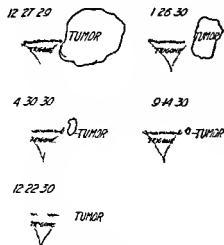


Fig 9 Various diagrams made by Dr McCrae on the dates as indicated in the illustration

year after operation of 51 per cent and only 7 per cent were 5 year cures. Scholl reports that in 168 operative cases 36.6 per cent with malignant papillomata died within a year and 71 per cent with solid tumors died within an average of 7½ months and that the operative mortality in papillary carcinoma was 12 per cent and with infiltrating carcinoma 20 per cent. *It must not be forgotten that these results have been obtained in operable cases while irradiation is used almost entirely in inoperable cases except by Barringer who uses operation for the placement of radium. The radiation methods may be any of the following*

- 1 Unscreened radium may be applied directly in small tumors and tumors about the neck of the bladder the radium being held in direct contact through a cystoscope as recommended by Barringer

- 2 Seeds either of glass or better gold may be implanted directly into the base of the tumor cystoscopically or suprapubically as recommended by Barringer, Keyes, Hyman, Burnam, Marson and others, but is suitable only for small tumors

- 3 The disease may be excised and then treated by deep roentgenotherapy

- 4 The disease may be destroyed by electrocoagulation and then treated by the implantation of removable radium needles as has been used by us for a time only in very large and inoperable tumors through a suprapubic cystotomy but which method has now been abandoned by us (Thomas and Pfahler, MacKenzie and others)

- 5 Through a suprapubic cystotomy the prominent tumor may be snared away and the base implanted with radium seeds (Barringer)

- 6 Deep roentgenotherapy may be used upon the primary tumor as has been recommended by Waters, Gunsett, Schmitz, Schnoebelin and



Fig 10 Complete disappearance of the tumor with a perfectly normal distention of the bladder wall as a result of the irradiation treatment no other treatment having been given. Briefly the history is as follows: Mr H. C. T. treated by Dr E. Spackman was under my direction since January 6, 1930. Patient had been passing bloody urine during 5 or 6 months. Cystoscopic examination made by Dr Lowrance McCrae and pneumocystogram by us showed an infiltrating carcinoma about the size of a half dollar occupying the bladder in the region of the left ureter. The patient received treatment through one portal of entry anteriorly a total of 325 per cent and 400 per cent of an erythema dose through each sacrospinous notch by means of high voltage X rays (200 kilo volts / millimeter of copper filtration / 50 centimeter distance) this giving approximately 400 per cent in the bladder area.

others and which method seems to me to be most satisfactory. It is to be recommended especially in the inoperable tumors and preliminary to operation. Inoperable tumors are those in which operation is contra indicated because of the poor general condition of the patient, by the size or location, or because of absolute refusal on the part of the patient. (Barringer classifies as inoperable (a) multiple carcinomata or large carcinomata of a base more than 4 centimeters in diameter (b) carcinomata which have affected the trigone and posterior urethra (c) carcinomata which have been previously operated upon and have recurred (d) carcinomata in patients whose age or condition contra indicated shock of operable removal.)

- 7 The tumor may be destroyed by electrocoagulation and then highly filtered radium (equivalent of 4 millimeters of lead) capsules packed into the bladder against the base of the tumor. This method appeals to me strongly and at some later date will be reported in detail.

George G. Smith finds about the same end results from excision, electrocoagulation and radium treatments 21, 27 and 29 per cent respectively free from symptoms after 2 years.

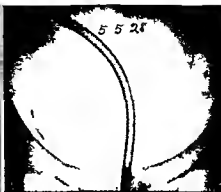


Fig 1 ft C 5 Mrs E K ag d 59 y f rred by D H J Tume P t ient
w s l d by f i l N mbe 5 9 6 On th d y f l l wing she passed bloody
u n She noted bl dy u m p t dly nd f i t w D T m n May 31 19 7 A
c y t p m nat m d by D J h n B Low n sh w d tumor mass n th
g i n f th l f t t th l f l m n H c m mended X ray or rad m therapy
tead f p t n O June 9 7 p m cystog am showed n s g l bro d
b sed t m m s s p p u mat ly 4 c n t m t i n d i m e t e l y n g th g i f th
l f t t Sh w s g i n h i h v l tag X ray t eat m e t d i c c t e t h o g h f i d n t
n o r l y d t h t m e t e r i l y n d t r u g h e a c h s c i t c r e g n o c r o f i n g
p o t h t m e g i g o o p e c e n t f a e y t h e m d s o e r e a c h o f t h
w h i h w l d q l p p u m t e l y o o p e c n t f i h g h v o l t a g X a y f i l t d t h o g h
/ m i l l m t f c p p w h i c h g i v e s p p u m a t e l y o o p c e t t h e t m a e a
T h i t e a t m t w s l l g i n w i t h i n a p e r i o d f b o u t 5 w e e k s e l i n g t h c o m p l t
d i a p p e a e f t h e t u m
F g Sh w s a p u m c y s t g r m m a d M y 5 19 8 sh w i g c o m p l t d s a p
p r a f t h e t m f m h u g h v l tag X ray t e a t m t a l o e d t h w a
c f i r m e d b y t u d s m a d b y b t h D T m d D L o w n e Sh h h d n
y m p t m c e

Barringer is more enthusiastic. In 98 cases with a pathological diagnosis there were 43 per cent of 3 year recoveries in papillary carcinoma and 29 7 per cent in the infiltrating variety. In 127 cases based upon clinical diagnosis there were 55 per cent of 3 year recoveries in papillary carcinoma and 27 8 per cent of 3 year recoveries in the infiltrating type. It will be seen therefore that from a prognostic point as to end results the clinical diagnosis has been as valuable as the microscopic.

Waters reported on 120 cases treated by deep roentgen therapy up to 1926 (one case of sarcoma). He gives no final statistics but concludes that the best treatment for superficial papillary carcinoma is a combination of deep roentgen therapy and radium applied to the surface of the growth while with the infiltrating growths when operable radical resection should be carried out. All others should be given a trial by deep roentgen therapy perhaps associated with suprapubic cystostomy and implantation of radium needles.

Grier reported on 17 inoperable cases with 3 recoveries treated by deep roentgen therapy.

Burnam reports on 186 cases of tumors of the bladder treated by irradiation. Of these 88 2 per cent were malignant and of the malignant cases 66 per cent were of the large inoperable type. Of

the 111 large carcinomata there were 11 cures (9 9 per cent) and of the 57 small carcinomata there were 20 cures (35 per cent). Of the 59 large and inoperable papillary carcinomata there were 7 cures (12 per cent) and 20 with palliative results. Of the 29 small and medium papillary carcinomata 9 were cured (31 per cent). Of the 49 large and inoperable infiltrating carcinomata there were 4 cures (8 per cent) with palliation in 13 cases. Of the 9 small and medium infiltrating carcinomata there were 5 cures (55 per cent) with palliation in 4 cases. Such results should make us consider irradiation in all cases of carcinoma of the bladder and should make us all keen to improve our technique, conserve normal tissue and do all possible to make a diagnosis early and treat thoroughly and skilfully from the beginning.

RESULTS IN OUR CASES

Our experience is limited to 83 cases of carcinoma of the bladder. All were advanced large and belong to the inoperable group. There were 63 males (75 9 per cent) and 20 females (24 1 per cent). The youngest was 36 and the oldest 78 years of age giving an average of 57 2 per cent years. Judged by the history of symptoms the average duration of the disease was 15 3 months.

TABLE II—COMBINED SURGICAL AND RADIATION TREATMENT

G th E c d Foll wed by X y T me t—e Cas s

| N m | A | D t | U l g t | D | R l | R m k |
|-------|----|--------|-------------|--------|-----|---|
| R G R | 6 | 0-6-07 | J B R be | y | D d | 3 f tm |
| H S | 63 | 8-7-6 | P P h | y | D d | P b bly d d y f tm |
| M G R | 5 | 0- | W B b k | 53 | D d | 3 mo h fte t m t G w h sed y rs b f X y t m t T d f curr |
| P C | | 5 5 3 | E E Gl d na | y m h | D d | m th f t m t |
| W S | 7 | 8-6 | B A Th m | y w k | D d | y f t tm |
| G L | 5 | 7 5 | B A Th m | y | D d | y f t tm |
| M M | 8 | 9 5 7 | J h J so | 5 m th | D d | 6 m h f t m t |

R m k These w l g fil g l ma d th w p b bly m p l t Th X y m l lta d d t
h m s g dise

G with E c d Foll w d by Rad m P ks n Bl dd a d X ray T e tm t—S r C

| N m | Ag | D | U l g t | Dur t | R lta | R m k |
|---------|----|-------|------------|---------|-------|----------------|
| D S B | 37 | 7 7 | C N | 3 m th | D d | yea ft t m t R |
| Mrs J S | 5 | 8-8 | B A Th ma | 3 month | D d | 4 y f m |
| J S | 6 | 9 | J D C | 6 m th | D d | m h ft t m t |
| T B | 37 | 2-9-5 | B A Th m | 3 y | D d | y ft t m t |
| M ss B | 5 | 6-9-6 | B A Th ma | 7 y | D d | m h ft t m t |
| S E | 5 | 3 | B A Th mas | 33 | D d | 6 m th f tm t |

L pl at ry Op t No R m l Foll d by X y Tre tment

| N m | Ag | D | U l g t | Dur | Res t | R m k |
|-----|----|-----|---------|-------|-------|-------------|
| V M | | 0-5 | C B f t | 6 m h | D d | y ft tm t |
| T S | | 0-5 | Leo H m | y | D d | m h f t m t |

f h pos pe N y f h s as f m wh h w d f use h l d b sed m t sa m l l h w cur m l f h
mo h f l w m h d s p f bl lta t m t g f r r Th w l d m d t e th f th mo l f h

The prostate was known to be involved by the tumors which were primary in the bladder in 5 cases out of the 63 males (7.9 per cent).

I am indebted to my associate Dr Leo D Parry for preparing the tables from my records. These tables show the classification of our cases of carcinoma of the bladder treated by irradiation (See Table I).

It must be realized that the 43 cases in Table I which were treated through suprapubic cystostomy were large inoperable carcinomata and while only 15.3 per cent of the recoveries passed the 5 year period it represents some progress. The technique for these procedures has been previously described in detail by the late B. A. Thomas and myself. While there were only 15.3 per cent of 5 year recoveries there were more temporary recoveries. However it is my present impression

from theoretical grounds and a few recent cases that the insertion of radium needles can be replaced to advantage by highly filtered radium units in the form of small packs within the bladder. (See Tables II, III, IV, V, VI, VII.)

SUMMARY AND CONCLUSIONS

1. Pneumocystography is a valuable means of determining the presence and outline position and amount of infiltration of a carcinoma of the bladder.

2. It can be carried out by any careful roentgenologist with sterile catheter, atomizer bulb and a hemostatic forceps.

3. Radiotherapy involves treatment by radium in the form of capsules, needles or seeds (glass or gold) and by the use of deep roentgentherapy either alone or before or after electrocoagulation.

TABLE III—ELECTROCOAGULATION AND RADIATION THERAPY

Growth Electrocoagulated Through Suprapubic Cystostomy Followed by Radium Packs in Bladder and X-ray Treatment—Five Cases

| N m | Ag | D t | U l g t | D t | R t | R m k |
|-------|----|-------|-----------|--------|-----|----------------------------------|
| E S J | 5 | 4 7 9 | E L a P l | m th | D i | 5 ft t tm t |
| M W S | 60 | 7 0 9 | B C H t | 6 m th | D d | 8 m th ft t tm t |
| N C | 5 | 8 9 | F L P l | y | Al | 5 ft t tm t |
| L S | 6 | 8 9 | W M k y | m th | D d | 7 m th ft t tm t Apopl cy—d y ft |
| G S | 54 | 6 9 3 | J C B d r | y | Al | 7 m th ft t tm t |

R m k Th 5 l g p bl gr w t t d by d m p l (th d ly) p k d g t th d d a Of th
 ma d ympt m f j q th 7 m th

Electrocoagulated Cystoscopically Followed by X-ray and Radium Treatment—Eight Cases

| N m | Ag | D t | U l g t | D t | R t | R m k |
|-------|----|-------|-----------|--------|-----|------------------|
| G L | 54 | 5 5 | I L L y y | 4 m th | D d | 3 m th ft t tm t |
| A S E | 63 | 5 7 6 | W M k y | y | D d | 7 m th ft t tm t |
| O A k | 56 | 4 4 | B A Th ma | y | Al | 7 y ft t tm t |
| A T | 5 | 5 5 | W H en | 6 m th | Al | 5 y ft t tm t |
| M L M | 7 | 5 4 5 | B A Th ma | 6 m th | Al | 5 y ft t tm t |
| N C | 65 | 9 5 5 | B A Th m | 5 | D d | 5 ft t tm t |
| M E B | 72 | 5 6 | D P P f | y | D d | m th ft t tm t |
| M B V | 63 | 8 7 | B A Th ma | 4 y | D d | m th ft t tm t |

R m k Of the 8 3 b m ympt m f ← 35 sp t (7 5 3 y) Th f th f th t m p t t w h h d
 l b d m l th p d m p l w k r y d y (f g 3) Th f th g r p p t th m f b l g p b f th
 m l d l f l t t g t p d y m p l w k r y d y (f g 3) Th f th g r p p t th m f b l g p b f th
 m l d l f l t t g t p d y m p l w k r y d y (f g 3) Th f th g r p p t th m f b l g p b f th

TABLE IV—IRRADIATION ONLY—TWELVE CASES

| N m | Ag | D t | U l g t | D t | R t | R m k |
|-------|----|-------|-------------|-------------------|-----|--|
| R B | 50 | 0 9 5 | A J S b b l | m th | Al | 5 y ft t tm t |
| J H M | 76 | 5 6 6 | E L P l | y — p | D d | 5 ft t tm t |
| J C | 51 | 9 0 7 | L H en | 5 — p | D d | 5 ft t tm t |
| G O | 5 | 5 3 | L H ma | 6 m th — p m t | D d | 7 m th ft t tm t |
| M M B | 63 | 5 7 3 | W L E t | y y | D d | 9 m th ft t tm t |
| G S | 63 | 9 5 | B A Th ma | 4 y | D d | 5 ft t tm t |
| M G F | 5 | 5 5 6 | W M k y | 8 m th | D d | 4 m th ft t tm t |
| A D W | 66 | 8 6 | C D Sh | 4 y | D d | 4 m th ft t tm t |
| M E k | 59 | 6 0 7 | J B Low n | 8 m th | Al | 5 y ft t tm t |
| G k | 38 | 5 8 9 | B A Th ma | m th | D d | 5 ft t tm t |
| H T | 58 | 6 3 | Th M C | 7 y | Al | 5 ft t tm t |
| M G S | 55 | 0 5 5 | J m e s A d | y | Al | 7 m th ft t tm t Sympt m f e— d m p p l d g t |

R m k Of the 8 3 b m ympt m f (5 3 5 7 2 m th) 35 sp t Th f th g r p p t th m f b l g p b f th
 l b d m l th p d m p l w k r y d y (f g 3) Th f th g r p p t th m f b l g p b f th
 m l d l f l t t g t p d y m p l w k r y d y (f g 3) Th f th g r p p t th m f b l g p b f th
 m l d l f l t t g t p d y m p l w k r y d y (f g 3) Th f th g r p p t th m f b l g p b f th

TABLE 1.—DURATION OF LIFE AFTER TREATMENT BY ALL METHODS

[illegible]

TABLE VI—OUTLINE OF IRRADIATION TREATMENT GIVEN IN SOME CASES WITH GOOD RESULTS

| h m | A | D te | U i g t | Sympt m f | T t m t |
|-----------|----|-------|------------|---------------------------|---|
| R B | 50 | 0-9-5 | A S bbel | $\frac{5}{y}$ Livi g | 6 5^{ov} \ y th gh f lds t 4 5^{ov} \ y th gh s f l d po t |
| D S B | | 7 3 7 | C N | $\frac{D}{d}$ f m | E th gh f l d p te Op th gh f l d t y 75^{ov} X bl dd y mg h 55 mm l tr bbe m d ta e- oo^{ov} \ y th h f l d oo^{ov} \ y th h f l d pos |
| J N C | | 8- | E LaP? | $\frac{y}{L}$ vi | G h dest ed by ry- oo mg h - d m p l mm drubber m d ta p h |
| J H S | 65 | 3 | W M h | $\frac{y}{L}$ vi g | El t gul f g th- 800 mg h - eedl t d b se fgr with |
| S M S | 8 | 3 | W M h y | $\frac{y}{L}$ g | El oc gul tu -64 mg h d l curr se d- oo^{ov} \ y th h po ta! ssfr H d d D T S l g pe ted po bl dd |
| 6 D S | 5 | | W M h ey | $\frac{D}{y}$ d-c k w | El troc gulat m h d l 33 ov \ y th gh f l d 500^{ov} \ Low f gh f l d p |
| 7 K G | 8 | | W M h | $\frac{y}{D}$ d tald th | El troc gulatoo fgr with- 6 mg h R d m Needles dar und b se f m |
| 8 G S | | 0-0- | G P M II | $\frac{D}{y}$ d-c se k w | El troc gul tu f growth- 4 mg b d m seedles inser ed d base fgr w h |
| M E B | | 3 | B A Th m | $\frac{y}{L}$ g | F lgu t f g th- mg h d l se d ov \ y fir thr gh f l d |
| M S F | | 8 | Le II m | $\frac{y}{L}$ g | 6 5^{ov} \ ss f h gh po l b F lgu tu fgr with-6 mg h d m seed se d b- oo mg hrs gs l mp fl w) seedles d b ass 54 m di ta |
| M C | | | B A Th m | $\frac{D}{y}$ d-c k w | El t d th b f g w h- 90 mg h f d m N dies se d f g with |
| O A K | 6 | | B A Th m | $\frac{y}{L}$ vi | El troc gulat -6 5 mg hrs f ms f p k bladd (C g tal tr as t) y y fir thr h po b |
| J M M | | 5 | B A Th mas | $\frac{y}{L}$ y g | F lgu tu fgr w h oo^{ov} \ y th gh po t |
| M E K | 5 | 0-0- | H J T m | $\frac{y}{L}$ y Livi g | oo^{ov} \ thr gh f l d 35 ov \ y th gh pos n lds H h l g w th s m pp d l sed |
| 5 A T | 5 | 0-0-3 | W H | $\frac{y}{L}$ vi | El trocagulat fgr w h ry oc p lly ov \ y thro gh po tal 50^{ov} X y hr gh pos er 5 po f s m d f e- f tr em mm sed f s l tm |
| 6 H T | 53 | 0- | T M C | $\frac{y}{L}$ g | 3 5^{ov} X y h gh f l d te 800^{ov} \ x y th gh f l d pos |
| 7 Mrs G S | 55 | 6-3 | J mes A d | $\frac{y}{L}$ m h L g | 700^{ov} \ y hr gh po tal used 9 ov \ th gh pos po l um- m. d ta ce pla mm |

TABLE VII—LOCATION AND EXTENT OF DISEASE WITH GOOD RESULTS IN EIGHTEEN CASES

| N m | Ag | D t | U l g t | F d gs | E p y | Op t | T t m t | Res lt |
|-------|----|-------|------------|------------------------------------|-----------------------|------|------------------------------------|--------------------|
| R B | 59 | 6-9-5 | A S bbel | E t t g l d | N | N | X y | L v g s y |
| D B | 37 | 7-3-7 | C N so | M u l g | N | X | R d m g u l t X y | D d m 4 y |
| N C | 57 | 8-9 | E LaPl | Post w l l d | N | X | C t r y Radium dl | L v g y |
| J H S | 65 | 5-3 | W M k y | Left d f b l d l d | X P p l y m | X | Co g u l t Radi m dl | L v g y |
| M S | 48 | 5-4 | W M k y | Left d b l d d s h d m l | N | X | C g l t R d m dl X y | L v g y |
| D S | 55 | | W M k y | M 6 hes d m t | X | X | C g l t R d m dl X y | D d o y u s k w |
| K G | 4 | 8-3 | W M k ey | M (l f w) po t w l l | X | X | Co g l t Radium dl X y | D d 6 y d t f |
| G S | 69 | 0-9- | G P M H | Mas post l l s by 4 | N | X | Co g u l t R d m dl | D d 7 y k w |
| M E B | 36 | 3 | B A Th m | P t w l l d | X P p l y m | X | Co g u l t Radi m dl X y | L g y y |
| M F | 5 | 2-8 | Leo H ma | N t f b l d d m l d 3 m d m t | N | X | C g u l t Radium v g s N X y | L v g s y |
| M C | 53 | 9-3 | B A Th ma | M l f t d s by 6 by 7 | N | X | C g u l t R d m dl | D d s y k w |
| O A K | 36 | 2-4-4 | B A Th mas | E t r p h y f b l d d m l b s e | X | N | Co g u l t Radi m | L v g y y |
| M L M | 7 | 4-4-5 | B A Th mas | Size f l m | X | X | Co g u l t R d m dl X y | L v g s y |
| E K | 50 | 6-0-7 | H J T m | S f l m p l w l l | N | N | X y | L v g s y y |
| A T | 5 | 6-8-8 | W H es | Size f w l t | X (R m by 3 t) | N | X y Co g u l t n | L v g y |
| H T | 53 | 6-3 | T M C | G w th f l d l l | X (R m by 3 t) | N | X y | L v g y |
| G S | | 6-9-5 | J B dahl | L f t p o t cm w l l 6 cm by 6 | N | X | X y Radi m | L g m th s |
| M G S | 55 | 6-3-5 | J m A d | M b l d d l d | N | N | X y R d m g n o | L u g y m th |

4 It seems that electrocoagulation is better than excision followed by radium or X ray treatment

5 Some very encouraging results have been obtained by irradiation alone Under such treatment the patient is usually relieved of hemorrhage and pain If our results can be made permanent and our percentage of cures increased and if in the early stages the growth can be destroyed cystoscopically it will be a great step in advance

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- 9 H I N A Th t cal (y t p) t tm nt
f c c m f th bladd by mpl t t f
d m ma t t b S g Gyn & Ob t
o 4 xx 87 83
KEYS F D R D L Th t tm t f bl dd t m s
with m t l ed c t g d m em t
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Id m P pl g e g the l c l t tme t of
m f th bl dde J Am M A 98 c
- 35 35
LO ER W E Op ato fo f th bladd
Am J R tg l 926 9
- 3 M c E DAVO W Bl dd pl ma S g
Gyn & Ob t 95 l 773 778
- 4 M s A CL FFORD Ob r t n t ty
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d m B t M J 99 38-39
- 5 PFAHLE G E Elect otherm c c ! t d
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S g Gy c & Ob t 94 783
- 6 Id m Th t fa f th tg d g os
ft m f th bladd Am J R tg ol 99
- 37
7 Id m Th t dy f t m f th bl dd by me
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Sept 7
- 8 Idem The N ysi the d g and t tm t f
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4 Med Ro t 98 J
- 9 SCHMITZ HE v d Jo EPH E F R tg y
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S g 9 45 46
- 4 WATTS C A F ye rs e pen c th
t e tment of t m f the bl dder by d p t
g therapy Am J Roe tge l 96 3
4

EMPYEMA WITH BRONCHIAL FISTULA SIMULATING LUNG ABSCESS AND BRONCHIECTASIS¹

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THE clinical manifestations of empyema with bronchial fistula are so different from those of uncomplicated empyema that from the diagnostic point of view it deserves separate consideration. While the latter presents itself usually as an obvious pleural disease, the former because a cough productive of large quantities of sputum is its outstanding symptom is apt to be confused with diseases of the lungs and bronchi. This is especially so when the empyema is small and encysted in which case the physical and roentgenographic signs are usually atypical. It has seemed worth while to call attention to this diagnostic problem and by citing cases point out the many similarities and the few essential differences between this condition and lung abscess, bronchiectasis, phthisis and other pulmonary diseases.

Rupture of a tuberculous cavity into the pleura is by far the most common cause of empyema with bronchial fistula. Lung abscess and gangrene frequently produce it. A superficial pulmonary infarct instead of regaining its circulation may die and be sloughed off, leaving a pulmonary defect with multiple bronchial openings into the pleura. Infection always either exists or supervenes. The condition may follow wounds of the lung and pleura although this is a much less frequent complication than one might expect. Spontaneous drainage of an unrecognized empyema whatever its origin is more likely to be by way of a bronchus than through the parietal pleura. Laennec while he saw but one case of empyema necessitatis saw many of empyema with bronchial fistula. Cases have been reported in which a simple serous effusion eventually eroded the lung and invaded a bronchus. Pulmonary cancer hydatids of the lung and pleura, bronchiectasis and foreign body in the bronchi are rare causes.

When an empyema is draining through a bronchus the physician confronted with a patient raising quantities of sputum often foul is led to consider pulmonary rather than pleural pathology and to make a diagnosis of lung abscess, bronchiectasis or tuberculosis. Even to one suspecting the condition the diagnosis is difficult.

The discussion of this problem was conducted by the author at the meeting of the American Association of Physicians and Surgeons held at Chicago, Ill., in 1911. The following cases were presented for discussion:

If the empyema is acute lung abscess is closely simulated. The two conditions produce practically identical symptoms. In both there is persistent cough, copious often foul sputum, fever, night sweats and all of the other manifestations of acute sepsis. The histories in both conditions present similar incidents: the onset either sudden or gradual with fever, pleuritic pain and slight non-productive cough; the sudden rupture of the abscess with the coughing up of a flood of pus and the subsequent slight improvement with the establishment of partial drainage. If the empyema has been preceded by a typical pneumonia the diagnosis is less difficult, but even here one is influenced to believe that it is an abscess rather than an empyema which has complicated the acute disease. If however the pneumonia has been atypical or the empyema has been caused by a small peripheral lung abscess or infarct as is not infrequently the case, there is little in the history to distinguish the two conditions.

While the classical physical and roentgenographic findings of empyema and lung abscess are radically different, actually the findings are rarely classical, often similar. In lung abscess the surrounding pneumonitis often hides the cavity on the roentgenograms and the practical occlusion of the bronchus draining it makes the physical findings those of atelectasis (flatness, absent breath sounds and decreased fremitus) signs indistinguishable from those of fluid. If a fluid level is seen on the roentgenograms it is frequently difficult to say whether it is an encapsulated pyopneumothorax or in a parenchymal abscess.

If the patient with empyema with bronchial fistula survives the acute stage of the disease and the cavity is not obliterated spontaneously, a chronic condition is established which is with difficulty distinguished from bronchiectasis. The characteristics of bronchiectasis are the periodic expectoration of large quantities of purulent sputum, the patient being free of fever and the other symptoms and signs of sepsis. In empyema with a bronchial fistula, as the walls of the cavity become thickened absorption through them is reduced to a minimum. As this takes place the fever disappears and the patient improves gradually in nutrition and general health. The inflammation and swelling in the efferent bronchus



Fig. 1. Pyopneumothorax with bronchial fistula. Right



Fig. 2. Pyopneumothorax with bronchial fistula. Left

which have hindered drainage and made the cough persistent and the cough like that of the bronchiectatic occurs only when the pus in the cavity has risen to the level of the bronchial opening. As in bronchiectasis the emptying spells are usually brought on by change in position or by exertion.

Fortunately in most instances the two conditions are readily identifiable by the physical and X-ray findings. In uncomplicated bronchiectasis these are few. The physical findings are slight dullness and coarse non-consonating rales found usually at one or both bases posteriorly and the X-ray findings are merely an increase in the linear peribronchial markings. The variations from normal are often scarcely detectable.

In empyema with bronchial fistula on the other hand the findings are those of encapsulated air and fluid in the pleural cavity. If these are extensive and classical the shifting dullness with tympany above it, the absent or amphoric breath sound and the succussion splash are easy of recognition.

Not infrequently however the empyema is small and loculated and the expected signs as

well as the fluid level on the roentgenograms are masked by pleural thickening. Such cases can easily be confused with those types of bronchiectasis in which there is parenchymal fibrosis or atelectasis or in which the main bronchus is so constricted that the lung becomes drowned with secretions. In this variety of bronchiectasis if the bronchus is patent the even increase in density of parenchymal fibrosis or atelectasis can be differentiated from that of fluid by the physical examination which in the former shows the increased signs of consolidation rather than the decreased ones of fluid. If the bronchus is not patent and the lung is drowned and airless the differentiations must be made by the demonstration of the bronchial occlusion. This can be done either by diagnostic bronchoscopy or by roentgenograms taken after the injection of iodized oil or by exploratory thoracentesis. The location of the heart is also of great importance in this connection. In fibrosis or atelectasis it is drawn toward the affected side while in the presence of fluid it is forced in the opposite direction.

Because the treatment of the possible conditions is so different a correct diagnosis is of the utmost



Fig 3 Roentgenogram taken after drainage of the empyema Case

importance. If there is a lung abscess exploratory aspiration with the risk of empyema is dangerous. Expectant treatment with salvarsan and postural drainage and later if necessary thoracotomy are indicated. If it is bronchiectasis vaccines, lipiodol injections, postural drainage and perhaps phrenicectomy are indicated. None of these procedures nor the regimen for pulmonary tuberculosis can possibly benefit an empyema which in most instances can be cured by a simple rib resection. It is a tragedy for a case of this kind to go for 8 years as did one of those reported below with diagnoses of lung abscess, bronchiectasis and pulmonary tuberculosis when he could have been cured in 2 months by the resection of a rib.

Each case is a specific problem. Success in diagnosis will depend first upon recognition of the frequency of the condition and consideration of its possible presence, second upon a careful history and physical examination and third upon the interpretation of the roentgenograms. These should always be taken with the patient in an upright position and in the anteroposterior, lateral and oblique positions. If these positions are used, one can demonstrate whether or not there is a fluid level and whether or not it extends to the chest wall. Plates taken after the injection of iodized oil are practically essential. If the case is one of bronchiectasis or bronchial occlusion there is no further doubt as to the diagnosis. In lung



Fig 4 Roentgenogram taken after the injection of iodized oil into the sinus which persisted after operation. Demonstration of bronchial fistula Case

abscess there is usually revealed a wedge shaped filling defect in the parenchyma with its apex toward the hilus. In empyema with fistula the lung is shown pushed away from the chest wall.

If after all diagnostic methods have been tried there is still a question as to whether the condition is empyema or lung abscess, exploratory thoracotomy should be performed without a preliminary diagnostic aspiration. I have already pointed out the danger of producing an empyema if aspiration is performed in the presence of a lung abscess.

It has been the purpose of this paper to discuss the diagnosis of empyema with bronchial fistula, not the treatment. In general the treatment is the same as that of uncomplicated empyema. The presence of the fistula contra indicates closed drainage and irrigations and makes rib resection the operation of choice. This is further indicated in that the temporary partial collapse of the lung favors the healing of the fistula. If the process is recognized and drained in its acute stage, both the cavity and the fistula will in most instances heal without further interference. If the fistula fails to close a sinus will persist. That it is the fistula which is causing the sinus can be demonstrated by roentgenograms taken after the injection of iodized oil. If the oil is injected into the sinus the



Fig 5 Py p e m t h a w t h b o c b l f i s t u l a R t
g g m t a k b f p e t w t h t b p a t e t t h e
p p t i \ f i d l e l e e C

plates will show filling of the bronchial tree in the affected region. Such a fistula can be closed only by dissecting out the tract to the surface of the lung, exposing an area about the bronchial opening, and cauterizing the lips of the fistula with silver nitrate. The wound is packed wide open and the cauterization repeated every week or ten days until the granulations have closed the opening.

If the empyema has become chronic the procedure is the same until the cavity has ceased to decrease in size and until the patient's condition has improved sufficiently to permit one of the operations indicated for chronic empyema.

C s e M J D w h t m a c e g t 4 0 y l d
w f i r s t t h A u g u s t H p t l m c s l t n
w t h D G s z F b r u a r y 5 9 3 H m p l m t s w c
g h t h t p d c t f l q t t s o f f l p
t m k s f e d g h t w t f s w k s d t
T h p t t d t h t h e d l w y s h n b j e c t l d s
w h c h f l l w d a f t r t h t m o t f i t h w i n t H
w a s p e r f e c t l y e l l d h d g h d r i g t b m m
T w m t h b f h w a f i r s t b d l o p d h d
c o l d d f w d y l t r t t l d o h u c b t f t a d
f c o t g h r o c g h s t h d p e w a t s
t g e g r a d l l y r s d h b g t l e h t d
r u s l i g h t f A b o u t w k f t t t t d h s d
d l y c o h d p r a l m o t h l f o f h l d T h h d a
f o l d T h s a m t h g c d a f w d y l t F l
l o w g t h s p t m g d l l y r e d a m n t d
b e c a m r y f l H t o p p d w k d t d t h h
p t a l o n J a n u a r y 9 3 H g r w s t d i l y w r e d
t u n e d r u m f f t 3 d g r y f t m



Fig 6 R e n i g e m t k n b f o p t w t h t h
p t e t t h e s t d p o t o A f f d i l t d g t o
t h t h o w l l t h l l a r y l e w a s b l C a s

E m t a o F b r u a r y 5 h w e d a m k e d l y m a
c a t d m u d d l a g e d m s i t t p i b d a d c o h i g
l m t a e s t l y H c h e k w s n k d f u h d
T h t m p t e w d e g e e s d t h p l s T h e
o l y b m a l p h y a l f i d g a w i n t h h e s t T h
w m r k d i m t a t f m o t f t h r i g h t h e m i t h a
A t t h g h t b p o t l y f o m t h l f t h s c p l
d w n a d p c u s n t w a s f i t d t h b e t h d
d i c t a l f m u t s w b e t A b t h i s w a r
t h e o f t y m p y S l o d e s o c

T h e r t g o r a m t a k e n t h t e o p o t o r p t
(F g 1) h w d w h t p p a d t b l g c a v i t y w t h
f l d l l e t h h t l r l g f i d T h l t r a l p l a t
(F g 2) h d t h t h w s m t h p o i n p a r t f t h
t h r a c c t y d p p c u m a t o w t h t h p o t
h e t w l l

A d g i s o f m p y m a w t h b h l f i t l a m a d
B e c a u s e t h w d i f f c e f p t w h e t h i t
w a l u g b e s e m p y m a a s p r a t i w a s n t p
f m d U d l o c l a t h t h b t h m d
c a p l h t h e n i g h t w r e c t d C f l i s o f
t h b b d i d t l g e m p y m c a t y t h e m f r o m w h i c h
a b o u t p t f i f o l p m i l a t t h w h i c h t h p t t
h d b e s w a s p t d O p d w e s t b
l h d b y t g t w l g s o f t r u b b r t b e s t b
p l l c t y

T h p t t s t o p p d c o g h i m m e d t l y f t t h
p r a t A t t h d f e e k h t m p r a t w a
m l d h w w l l t h d t y T h d
t b w k p t p l f o r a b t o w k s d t h g r a d
a l l y h t d d w t h d w t h t g m h
h w n t h c a t y w o b l i t a d
T h s t h h e s t w l p r s t d d w h t h
p t t f d b s x p r a t o a l d b h d m u n



Fig 7 Pyopneumothorax with bronchial fistula. Roentgenogram taken before operation showing multiple fluid levels. Case 3.

through it. Roentgenograms taken after injection of the sinus with lipiodol showed that it led into a bronchus (Fig 3). The patient was told to go back to his work and return in 6 months if the sinus was still present. At the end of 3 months it had closed and has remained so to the present time.

CASE 2. Mr J. W., a white mine operator of 52 years was first seen in consultation with Dr. Hollands and Dr. I. H. Chilcott at the Illinois Masonic Hospital on August 4, 1930. His complaints were cough productive of large quantities of foul purulent sputum, fever, weakness, and sweats of 1 month's duration.

Two and one half months before he was first seen he developed a bothersome dry cough. This did not make him sick in any way and he continued about his work. One month later he was awakened suddenly at night by a terrific pain in his right hemithorax. The pain was very severe and he was unable to get his breath. The next day he suddenly coughed up a flood of very foul sputum mixed with blood. By evening of that day his temperature had risen to 104 degrees. He improved somewhat after this but continued to be very ill.

Physical examination showed a large, well-developed elderly man lying in bed and coughing incessantly. His temperature was 102 degrees, pulse 20, respirations 28. There were no abnormal findings save in the chest. The motion was practically equal on the two sides. The heart was displaced slightly to the left. At the right base anteriorly there was an area of dullness the upper border of which ran from the cardiohepatic angle upward and outward to the right nipple and then downward to meet the lower dullness again in the midaxillary line. Over this area the breath sounds and tactile vocal fremitus were absent. Red blood cell count was 3,700,000; hemoglobin 60 per cent; white blood cells 13,700.

The roentgenogram which had been taken with the patient in the supine position showed an even increase in density at the right base with a hazy upper border which



Fig 8 Pyopneumothorax with bronchial fistula. Late roentgenogram taken before operation. Case 3.



Fig 9 Roentgenogram taken after operation. The multiple fluid levels were in the same empyema cavity. Case 3.



I g o P y p m th with b h f i t l a R o n t
g o g m t k b f o e p t o l d d l h s h e e n i
j t e d t d m u n w h t h e l e o w a t p u l m o a y
t p l m r y T h k g o f t h p l m s k s t h
f l d l e l C 4

se l i g h t l y i n t h a l l A l t h o g h t h p t t w s
t m e l y k h w t k t t h r a y d p t m e n t a d
a f t o d i z d u l h d b j e c t d w p p t e d i
p r i g h t p t w h i t h e p l t w x p d t
s h d t h t t h w a b s t r u c t f i t h b c h s
B r o h m h d b c o d d l t e a l e d
l o o t t h l w p s h d y f m t h c t w l l a d
t h t t h r w f i d l e l t h a l l b t w t h l
d t h r b

A d g f m p y m w t h b h f i t l w s m d
O t h p r a t t b l x p l t r y p r a t w a s p
f m d t h e d l h e t d i n t h f i f t h t c o s t l
p c t h h t j t b e l t h p p l T h k p w s
b t a d R e s e c t f o p t f i t h f i f t h r b t t h t
d c f i t h p t p l e l d t m l l o c l t d
m p y m t y O p d r a g e w t h l h d
T h p a t d c g h m m d t l y f l w g t h
p e a t n d h t c h d B y t h d f w k
h t m p t h d f a l l t o m a l d h w b l t
l t h p t a l T h d r a g t b w k p t p l
f b o t m t h d w t h g r a d l y w t h d w
T h w d b d h e a l e d m p l t l y m t h a t t h p
t T h p t t h a g d h i s m l w h t d
h o g h

C s e 3 M G W w h t t r u t r a l t l w o k
48 y e a r s l d w s e e n l t t w t h D M B B s
t t h C o l m b H p t l O t o b 7 93 H m
p l t c h p d t f 30 f f l p l t
p t m e h 4 h r s f w k n d h i s w t
O A u g u s t 93 w h l w k t h t r a d t h
p t t f l l r a l t n e d b r o k b t h h e s f h
n h t l o w l e e T h e w s j r y t h h e s t o t
o t h e r p a r t f t h b o d y T h e w a s c o d r a b l d p l c e
m e t f i t h f r a m t s d h a c q t y k e p t
b e d w t h h u l e e t r a t H h a d h o t h



F R e t g e o r a m t a l f t d g f t h e
e m p y m a l d i z e d o i l h b j t d t t h e t y
t o d m t t e t s o t l C 4

c o m p l t d h s t e m p t w m l u t l b o t
m t h i t h s u d d y d l p d e p a i n t h e
g h t l w t h D u n t h f i t h e d y h d a
l t l d t h t d y d l p d f o l d e e a d
h e r a g o d b l a m o t s o f f o l p r u l t p
t m T h p t m g d l y c e s e d i n m t t u l
f w d y s h e w a s u 3 c e s a d a y i l c o t i e d
g w i n g a d l l y w k o h i n e s s a t l y d r u
t e r n o o t m p r a t f d g r e s H i s p l e
r a e d b t w e g a d o o d

A t g g r a m t k t h d y f t e t h s e t o f h i s
p h w d e n d e n s t y i t h e g h t l o
f f i e l d w h c h e r y h a c t s t o f f i d t h
p l r a l c a t y O t k w k i t h o w d m l t p l
c a t d m l t p l f l d l T h l t r a l p l t t a k
t t h t m e s o f p t c l a t t t h a t t h w s o
l l t h y p t s f t h c a t t h e s a t t a l p l a n e o f
t h h e s t

P h y l e m t m d w t h t p t t h t u n
p o t h w d t t h w f i t e s t p e c u t t h
b f i t h g h t p l l c a t y t h p p b o d f w h h
r a n h z t l l y f r w a d f m t h g l e f i t h c a p l a
t h h t h e a l l t t h t m V o b t h s o d
d f m t w m a k d i l y d o t h u r e
T h r e w t h f i t t t o t h r i g h t f t h
t e r m t h e u p p r b o d f w h c h r a t w r d f r o m t h
t e r m t t h a t a x i l l r y l T h e s e l s f d l l
e s s h i f t t h p t t h g e d h p o t u
A d u a n s e m p y m a w t h b r o h l f i t l m a d
T h m l t p l f l u d l l w e b l d t b e t h s a m
c a t y d t b e c s e d b y p o c k t g s f f i d h l

pleural adhesions. Such pictures are not uncommon in instances in which artificial pneumothorax is complicated by an effusion.

Aspiration had been performed unsuccessfully posteriorly by another consultant. For this reason and because the roentgenogram and the physical examination indicated that there was fluid in the lower thorax in the anterior axillary line aspiration was performed at this point. I used similar to that which the patient was raising was obtained.

Under local anesthesia a segment of rib was resected at this point. Incision through the parietal pleura led into a large empyema cavity containing pus and air. The pus was aspirated and open drainage was established. The patient stopped coughing immediately after the operation and his temperature came down to below 100 degrees.

Ordinarily I do not hesitate to drain an empyema anteriorly so long as the incision is toward the base of the cavity. Wherever the opening drainage may be made efficient by having the patient lie on the incision. This patient had difficulty in doing so because of the cast on his leg. He continued running a slight fever and it was necessary to irrigate the cavity carefully with hypochlorite solution to bring down his fever. The cavity is small and decreasing steadily in size 6 weeks after the operation.

CASE 4. Mr. J. G., a single white laborer, 32 years of age, came to the dispensary complaining of cough productive of large quantities of sputum.

Eight years before the patient had had an acute respiratory disease from which he had a prolonged convalescence. He was confined to bed for many months. During this time the cough which had been present from the start became increasingly productive until he was raising as much as a pint each 24 hours. He improved gradually in general condition and was eventually fever free and able to be up and about. His cough continued the same. Since that time he had been in fairly good health except for the very bothersome productive cough. This cough occurred chiefly in the morning when he got up and at night when he went to bed. It was also brought on by bending over or by exerting himself unduly. He had been told by different physicians that he had lung abscess, bronchiectasis, and pulmonary tuberculosis. He had been sent to Arizona and to California but had failed to improve.

Physical examination revealed a relatively well developed and nourished adult male. The only important physical findings were those encountered in the chest. Extending from the apex to the base in the axilla and from the mid

clavicular line to the midscapular line was an area of dullness to percussion. Over this area the breath sounds were absent and the tactile and vocal fremitus greatly reduced.

The roentgenogram showed an area of greatly increased density occupying the entire axillary portion of the left lung field. The plate taken after the injection of iodized oil showed that the lung was pushed away from the chest wall. Aspiration gave thick yellow pus of the same variety that the patient was coughing up. Following the establishment of drainage by the insertion of a tube the patient stopped coughing and has not coughed since. The empyema cavity decreased markedly in size but failing to close completely had to be obliterated by a Schede operation.

SUMMARY AND CONCLUSIONS

1. Empyema with bronchial fistula closely simulates lung abscess or bronchiectasis. The acute cases simulate lung abscess, the chronic ones bronchiectasis.

2. Four cases are presented in which the diagnosis was uncertain and difficult.

3. It is important to consider the condition in all cases presenting the symptoms of cough and copious sputum.

4. A careful history and physical examination and roentgenograms taken in the anteroposterior and lateral upright positions before and after the injection of iodized oil are essential to the diagnosis.

5. Diagnostic aspiration should not be performed for fear of infecting the pleura in case a lung abscess is present.

6. The treatment of empyema with bronchial fistula is drainage by rib resection. Closed drainage and irrigations are contra-indicated because of the bronchial opening.

7. In the acute cases the fistula and cavity will usually close spontaneously following drainage. If they do not, secondary operations are required.

OSTEOCHONDROMATOSIS OF THE KNEE JOINT¹

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ACCORDING to Halstead the first systematic study of loose bodies in joints was done over three hundred years ago by Pechlin a Swedish surgeon. Loose bodies may be composed of unorganized tissue such as rice bodies or made up of organized tissue as cartilage fibrocartilage or bone.

Osteochondromatosis is a rare pathological process in which pedunculated and loose cartilaginous bodies are formed from the synovial membrane of joints the knee being by far the most commonly affected. This condition is not to be confused with that of osteochondritis desiccans or osteochondral fracture in which the loose bodies arise from the articulating surfaces or in those cases of advanced osteoarthritis presenting loose bodies.

Lannaec in 1831 is said to have first called attention to loose bodies arising from the membrane and he believed they came from the sub-synovial tissues. In 1836 Brodie mentioned seeing several cases and he felt that the process arose from the external surface or within the synovial membrane because the membrane could be seen to be reflected over the bodies before they became detached. This is in close agreement with the present conception of their origin. Brodie states:

In the museum of St. George's Hospital there is a specimen of a knee joint the inner surface of which is lined by a great number of small pendulous excrescences connected with the synovial membrane and there is a reason to believe that the excrescences were the result of long continued inflammation of the synovial membrane.

Osteochondromatosis is usually monoarticular and is commonly to be recognized in early or middle adult life occurring in the following order of frequency: knee, elbow, shoulder, hip, ankle and wrist. In a review of 19 cases by Jones 12 were not over 40 and 8 were under 30 years of age. The 4 cases here reported were all in females under 45 years of age. The majority of cases reported in the literature have occurred in males substantiating to some degree the part trauma would appear to play in its etiology. Rivford has recently reported a case in a man of 60 years and while it is commonly seen much earlier no age period is exempt.

The exact cause has not been proved. The history and physical examination rarely tend to sup-

port the infectious theory. The cases here reported all gave a history of trauma to the joint which the patient thought marked the onset. In many of the cases reviewed a similar finding was noted. One is therefore impressed with the fact that it must be an important factor. It may not necessarily be direct trauma but irritation produced by wrenching or twisting of the joint. In 1907 Lexer advanced the idea that these osteochondromata arise from fully developed embryonal rests and pointed out the intimate developmental relationship of the synovial membrane to cartilage. The primitive connective tissue which may normally persist in the region of the joint capsule has been thought to give rise to cartilage which in turn can become ossified through irritation or infection. These loose bodies have therefore been thought by Geschickter to represent an overstimulation of a normal process. There would appear also to be some relationship between this process and various types of neoplasia. After an extensive study of its etiology and pathology Jones states: "From a developmental standpoint one is led to the consideration of this process as one of the tumors. In considering the relationship of the synovial membrane to tumors in general one is reminded of the fact that other neoplastic diseases arising from the membrane have been reported for instance fibromata, hemangiomas and endotheliomas. The frequent history of trauma introducing their onset is not unlike the history of many neoplastic processes. Henderson has reported a case of osteochondromatosis of the knee joint associated with a malignant chondrosarcoma of the lower end of the femur of the same side. In this connection it may be of interest to note that in Case 4 operation had been done for an intestinal obstruction at operation a huge megacolon being discovered the exact cause of which was undetermined."

Histologically the joint capsule is composed of two layers the outer stratum fibrosum and the inner stratum synoviale. It would seem that these cartilaginous rests begin to grow from the fibrous layer and push their way toward the joint cavity (see Fig. 8) growing to different sizes before being cast free into the joint. The question as to the portion of the joint first involved has been studied and while any portion of the membrane may be the site the junction of the joint capsule



Fig. 1. Roentgenogram from Case 1 showing many loose bodies free within the knee joint.

and the periosteum has been noted to be frequently first affected. It is probable that the type of injury may be the deciding factor in the portion of the joint first involved.

In Case 1 when the joint was opened it was noted that the articular surfaces proper appeared quite normal but at the periphery of the femoral articular surface at the junction of the synovial membrane and joint cartilage were small attached osteocartilaginous masses which were thought to be loose bodies in the process of formation. In addition to these there were noted several similar masses attached to the synovial membrane in the suprapatellar pouch. In Case 3 we were able to obtain a roentgenogram taken 6 years before which is here reproduced. On close inspection a few calcified areas can be identified in the posterior portion of the joint which would appear to be the beginning of the process in this case (see Fig. 5) and also illustrates the chronicity of this type of growth. While these ossifying papillomatous masses are attached nutrition and growth can easily continue but when the bodies wander loose in the joint the question of their continued growth becomes one of speculation. They may receive nourishment by reaching themselves temporarily to the membrane or from the joint fluid itself. Some of the earliest studies have indicated that the synovial fluid is



Fig. 2. Gross appearance of the loose bodies removed from the knee joint in Case 1.

not only a lubricant but also rich in proteins in organic salts and sugar. In a study of loose bodies in joints Strangeways concludes that the constituents of the synovia are responsible for the changes observed in bone and cartilage with certain types of arthritis. Phemister points out that the synovia is enriched by irritation which the loose bodies produce. Certainly as Forkner has recently observed a need for further study and research of the normal and pathological joint fluid is evident. The growth is believed to be entirely limited to the cartilage and fibrous tissue cells in these aberrant masses as cross sections of the larger loose bodies have been reported as



Fig. 3. Photomicrograph showing cross section of one of the loose bodies in Case 1. Note the absence of any areas of calcification. Areas of poorly preserved cartilage with a center of degenerated tissue can be seen.



Fig 4 Lateral roentgenogram of the right knee in Case 3 showing many loose bodies clustered together.

showing only degenerated bone in marked contrast to the microscopic appearance of the attached bodies (see Figures 9 and 10).

There appear to be at least two types of osteochondromatosis: first those cases in which one or more usually multiple loose bodies are free within the joint. These may be of varying size—the largest in Case 1 was three quarters of an inch in diameter—oblong or round with glistening white cartilaginous surfaces often pitted and presenting numerous bosses. When packed



Fig 6 Roentgenogram of the knee in Case 3 showing a large loose body.



Fig 5 Roentgenogram of the knee in Case 3, 6 years after surgery, showing the results of treatment.

closely together definite facets may be formed and occasionally these bodies may be seen neatly packed together in the posterior pouch of the knee joint. Their tendency is to wander about though they often gravitate backward during movement and produce remarkably few symptoms. The microscopic appearance of one of these loose bodies is shown in Figure 3. It is covered with a capsule of fibrous tissue and areas of poorly preserved cartilage cells scattered throughout. The absence of any area of calcification is striking.

CASE 3. A woman, 35 years of age, met with a fall in September, 1933, which resulted in a bilateral tenderness of the knees. She gave a history of definite tenderness of the knees, which had been present since the fall. She had no other symptoms. She was examined by a physician who found tenderness of the knees. She was then referred to me for further examination. I found tenderness of the knees and a large loose body in the right knee. I removed the loose body and the patient was cured. She has remained well for 6 years.



Fig 7 Photograph showing the gross appearance of a portion of the material removed from Case 3. A synovectomy of the anterior portion of the joint was done. A the fat pad B a portion of the synovial membrane showing many attached masses

The patient was admitted to the Orthopedic Service at Bellevue Hospital and operated on September 24 1930. A curved incision was made along the medial border of the patella under Esmarch and the joint opened. Nine loose bodies were recovered one large one being dislodged from the intercondylar notch with difficulty (see Fig 2). The wound closed in layers and a firm pressure bandage was applied for the next 10 days. The wound healed *per primam* and at present the patient has a range of motion from 130 to 80 degrees and complains of no pain or weakness in the knee.

CASE 2 A woman 44 years of age came to the clinic complaining of persistent pain in both knees for the past 18 years. The pain is worse in the right knee. She stated that 18 years ago she had fallen striking rather heavily against the right knee. It had given her so much trouble that 9 years ago she had had a roentgenogram taken which had been pronounced negative. The pain in this case was quite marked.

This woman was in fair general condition. She had double knock knees and walked with both feet in abduction. There was crepitus on movement of both knees but very little restriction in movement. The patient felt that the pain was most marked in the right knee when she was going down stairs. She had very little swelling or local sensitivity and gave no history of sudden sharp pain characteristic of a mechanical block. Roentgenogram of the left knee showed a mild degree of hypertrophic arthritis; this was more marked on the right and there were noted a number of loose bodies in the suprapatellar bursa and in the posterior portion of the knee joint. Removal was advised but the patient refused and did not return (Fig 4).

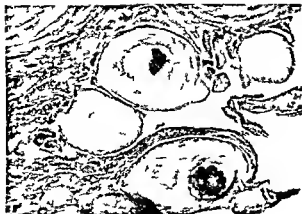
Another and somewhat different type but thought to arise from the same underlying cause



Fig 8 Photomicrograph showing several early stages in the development of the osteochondromatosis in Case 3. Note the growing bodies that are here observed below the synovial layer

is shown in Cases 3 and 4. Here the bodies in great quantities were found both free and attached and this type would appear to resemble a neoplastic process more than the cases described. As these synovial chondromata become visible in the roentgenogram only after they calcify or ossify at their center in the pedunculated masses the earlier cases must pass unnoticed for a while. Hesse describes a case that was not suspected until operation because of the negative findings. These 2 cases of the diffuse type here reported represent a late stage.

When the joint was opened in Case 3 a remarkable appearance was noted. The whole interior of the joint appeared studded with literally thousands of small glistening pearly white bodies about the size of seed pearls. They arose from every conceivable portion of the synovial membrane even partially encroaching upon both semilunar cartilages. Many of these bodies were attached to the membrane by tiny stalks; others were free within the joint and many had fused together forming small clusters which popped out from the folds of the joint whenever it was moved (Fig 10). The photograph shows the gross appearance very inadequately (Fig 7). There was noticed a distinctly rancid odor from this disorganized joint. This observation as far as the author has been able to discover has not been mentioned in other cases reported but was so marked and distinct in this case that it is thought worthy of mention. Microscopically the sections of this case showed dense connective tissue through which are diffusely distributed many small circumscribed and encapsulated areas. These consist of fibrous connective tissue either completely or partially replaced by fibrocartilage.



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l m e m b e c a b n t o b e l t d th m s s
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d e s f p a p u l l m t s y n t h o w n C e g

or bone Some of these nodules can be identified below the synovial layer in varying degrees of development before they have projected themselves into the joint cavity (Figs 8 and 9) Many of these nodules project beyond the synovial surface and give the appearance of a chronic synovitis The sections of this case were submitted to Dr Ewings who stated It appears to be an ossifying papillomatous synovitis that has taken on the aspect of a benign neoplasm

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A b t o y b f the p t e n t t d h e w t d d
h d t h k d h o t l y t h r f t h n t n t
l m t t n f m m t Sh e d h k g d m



F g R t gram f m C e 4 h w a d i f f
t y p f t e o h d m a t f t h k p o t Th c s
t o p t d u p b u t t h e r t g g p b p p
t y p c a l



F o Phot m e g p h w i n g c o s c t f
e l f s d l o o b d e s e m d f m C 3 N d
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l l c a b e d e n c f t h t t e l e f t h
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g o f t h k f o e r a l m t h s Th k n e e w l y
m d e t e l y s t i m m t n d h d f l h t
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w o m e a t p h y f t h r i g h t h m c l e s Th k
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d p t s p p t l l w t h t j t e a p u l t l a g s t
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Th p t e t w a s d m t t e d t o t h p t d S o f
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The t u l t y n l g t h m d l b d o f t h p t l l
w s m d u d E m c h d t h j t p e d Th g r
a p p a h b e d e s b e d b e l y n t o m y
c m p l e t p b l w s p r f r m d o n t h t n o r p t
o f t h k e j u n t Th w d w c l o d l a y e s d t
t m p t m d t d s s t u t t b e c l f e d m e i t h p t
t p o t Th s u s c f l B t h d h e a d d
e p m m d t h p t t l e s c e w d l
W b l t e n t h c l s h h d b u t 40 d g

g i m t n f t m l m s t i l l y t e d e d p o t
d w a b l t c y h h s k t h t p t
Th p t t n o t w l l g t o h a t h t t m p t m d
f t h e m l f t h p o t n l f i e d m d s b
i g w a t b d f y t n f t h p o t h e t n
p t f t h e j t

C a s 4 A w m 4 y a f g w n D e c m
b 5 93 c m p l g f t i f f t h l f t k n e S h
t e d t h t 6 y e a a g h f l l t h a g t h l f t k n g n t
t h g o d a d b d l y t t g t t t h a t t i m e Th j t
b c a m e w l l w t h e a f c e c h y m t h a t e o
s u r f S h e r d b k g d m a g m a n y t m e s b t
t h j t b c m j g l y t u f f a d p f l R t
g g m s t k n f w m n t h f t t h g l i n y
w t l b l b t t h e l d p t w n g t s a f
a y n o t Th k e h a b m q t t u f f b t t
p r e s t n t p n f u l Th p t t f e l h w t h a t t h e
j t w e a k

Th w m s f d t S h w l k d w t h t h e
l f t k n h g h t l y f l d b t c m p l d f p Th

patient stated that she had been operated upon for an intestinal obstruction and presented a colostomy. Her general surgical record at Bellevue Hospital disclosed that she presented a huge megacolon, the exact cause of which is undetermined. Examination of the extremities revealed nothing unusual other than the left knee. The knee was held in an attitude of about 10 degrees extension and there were only a few degrees of motion present. There was some enlargement of the joint but no synovitis or sensitiveness. Operation was advised but refused (Fig. 11.)

In these 4 cases the absence of symptoms other than those caused by mechanical blocking was rather striking. None of the cases at the time of examination presented an increase in the joint fluid or local heat or redness. The chronic duration with a history of wrenching or twisting of the knee followed by occasional sharp pain and increasing limitation in movement or a feeling of weakness about the joint was the usual history. Therefore the roentgenogram must still be regarded as the deciding factor in the diagnosis of osteochondromatosis.

The treatment is surgical. In the cases presenting multiple loose bodies the removal relieves the mechanical obstruction. Sometimes this is technically quite difficult as the bodies may disappear deep into the joint or become lodged in the intercondylar notch of the femur as occurred in Case 1. Platt has suggested flushing the joint with saline under considerable pressure to loosen and dislodge elusive bodies. It is also helpful to make a careful pre-operative examination of the roentgenogram counting the loose bodies at the time of operation to see if these tally with those noted in the roentgenogram. In the diffuse type of the disease a synovectomy as complete as possible would appear to be the method of choice. A curved incision along the medial border of the

patella the so called utility incision permits an extremely satisfactory view of the anterior portion of the knee joint with the minimum amount of bleeding. For exposure of the posterior portion of the joint one may use the posterolateral or posteromedial incision described by Henderson or the popliteal approach advocated by Brackett and O'good.

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THE OPERATIVE MORTALITY AND MORBIDITY OF PARTIAL GASTRECTOMY FOR PEPTIC ULCER

AS OBSERVED AT THE KLINIK EISELSBERG 1924-1930

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THERE exists today a voluminous literature concerning every phase of the subject of the medical and surgical treatment of peptic ulcer of the stomach and duodenum. Nevertheless because of the wide divergence of opinion contained therein it would seem of value to report statistically the results immediate or late of any large series of cases submitted to treatment by any single procedure. From the aspect of surgery this has been done excellently in the symposium on treatment of ulcer in the *Annals of Surgery*¹ where the results of various large American clinics have been made known. Inasmuch as the consensus of opinion favored gastroenterostomy particularly for duodenal ulcer it seems worth while to bring out some of the results of more radical surgery obtained in European clinics and more specifically the mortality and morbidity rates observed at the I Chirurgischen Universitätsklinik in Vienna (Vorstand Prof. Eiselsberg).

For this purpose 606 consecutive cases of peptic ulcer observed between January 1, 1924 and January 1, 1930 and treated by gastric resection will be presented. The statistics shown were obtained from the clinical course from operation to hospital discharge.

As the scope of this work is largely statistical no attempt will be made to review in detail the literature of gastric resection of ulcer. Excellent reviews are to be found in the different publications of Finsterer von Haberer, Starlinger² and others.

This series comprises 449 cases of ulcer duodeni, 137 cases of ulcer ventriculi, 17 cases of ulcer ventriculi et duodeni and 3 where the pathological diagnosis of perigastritis adhesiva (no ulcer being found) was obtained. In 27 cases the resection of exclusion was performed and in all others the ulcer bearing portion of stomach or duodenum was resected with the distal two thirds of the stomach.

The pre-operative, operative and postoperative treatment as given by Starlinger is identical with

the treatment in the Eiselsberg clinic and does not require repetition here.

Anæsthesia has been predominantly by the open drop ether method though local anæsthesia (splanchnic), spinal and gas oxygen anæsthesia have been employed. There was no appreciable difference in mortality or morbidity though it must of course be taken into consideration that the cases for local anæsthesia represent a somewhat selected group where ether had been thought dangerous. The following table shows the distribution of cases.

TABLE I—ANÆSTHESIA

| | |
|----------------------------------|-------|
| Eth (pandopmethd) | Cases |
| Nitrodoxygen | 56 |
| Spinal (sp. ocan) | 8 |
| Local (filtration and plethoric) | 8 |
| Local (filtration and th) | 4 |
| Bilateral thoracic | 1 |

The most popular type of operation has been that modification of the Billroth Type II in which the cut end of the remaining third or fourth of the stomach is united in its entirety with the jejunum retrocolically, the oral portion of the jejunum being sutured to the lesser curvature. Where conditions have been favorable the Billroth I in the end to end or end to side (supra or infrapapillary) modification has been employed. In those cases in which it was feared that excision of the ulcer bearing duodenum might injure the pancreas or biliary tracts the Eiselsberg resection of exclusion was employed (*Resektion ur Ausschaltung*). There was little or nothing to indicate any difference in mortality or morbidity according to the type of operation performed.

TABLE II—OPERATIONS

| | |
|---|-------|
| Bilateral II with total gastrectomy | Cases |
| Bilateral II with total gastrectomy and enterostomy | 528 |
| Bilateral II with total gastrectomy and enterostomy | 27 |
| Bilateral II (1 on pylorus) | 2 |
| Bilateral II (1 gastroduodenal) | 2 |
| Bilateral II (inf. papillary) | 27 |

The mortality for the entire series was 5.44 per cent. As might be expected there is con-

An S g
H b e H Leh b d Ch g A E l b g g w i d m
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S l i n g F A b f k l n Ch 7 1 N g

siderable variation in the mortality rate in perforated and non perforated ulcer as well as in ulcer ventriculi as contrasted with ulcer duodeni

TABLE III—MORTALITY

| | Pe | c | t |
|-----------------------------------|-----|----|----|
| Total resections | 606 | | |
| Deaths | 33 | 5 | 44 |
| Ulcer duodeni (not perforated) | 422 | | |
| Deaths | 16 | 3 | 79 |
| Ulcer duodeni (perforated) | 27 | | |
| Deaths | 3 | 11 | 1 |
| Ulcer ventriculi (not perforated) | 134 | | |
| Deaths | 14 | 11 | 44 |
| Ulcer ventriculi (perforated) | 3 | | |
| Deaths | 2 | 66 | 66 |
| Ulcer ventriculi et duodeni | 17 | | |
| Deaths | 0 | 0 | |
| Perigastritis adhesiva | 3 | | |
| Deaths | 0 | 0 | |

The most frequent causes of death were pneumonia and peritonitis in one or another combination. As the causal factor of peritonitis as determined by postmortem may be of interest they are tabulated separately below

TABLE IV—CAUSES OF DEATH

| | Ca |
|---|----|
| Pneumonia | 8 |
| Pneumonia and ileus | 1 |
| Pneumonia and peritonitis | 0 |
| Pneumonia subphrenic abscess | 6 |
| Pneumonia subphrenic abscess and pleurisy | 1 |
| Peritonitis | 14 |
| Peritonitis and hemorrhage | 1 |
| Subphrenic abscess | 1 |

TABLE IVA

| | |
|---|----|
| Peritonitis—total | 21 |
| of unknown origin | 11 |
| Due to | |
| a—Anastomosis suture line leakage | 4 |
| b—Duodenal stump leakage | 2 |
| c—Ileus (strangulated) | 1 |
| d—Perforated ulcers | 3 |
| e—Subphrenic abscess leakage of anastomosis | 2 |

The following cases presented features somewhat out of the ordinary and are here abstracted

CASE 1. A patient aged 44 years was operated upon under local anesthesia for ulcer duodeni. An infra papillary Billroth No. 1 was performed. On the sixth day after operation a laparotomy was again done because of severe pain in the epigastrium. In the anterior suture row of the anastomosis was found a small perforation which was closed over and an anterior gastro-enterostomy with entero-anastomosis was performed. Death occurred 10 days after the second operation. At postmortem there was found pneumonia, purulent diffuse bronchitis with localized peritonitis.

CASE 2. A patient aged 37 years was operated upon under ether anesthesia for ulcer duodeni. An infra papillary Billroth No. 1 was performed. There was much vomiting and on the eighth day after operation the abdomen

TABLE V—COMMON COMPLICATIONS

| | Cases |
|---|-------|
| Pneumonia | 14 |
| Pneumonia and pleurisy | 1 |
| Pleurisy | 4 |
| Subphrenic abscess | 2 |
| Severe postoperative bleeding and vomiting (1) | 4 |
| Diarrhoea | 5 |
| Secondary suture (wound bursting open) | 2 |
| Thrombophlebitis | 2 |
| Infarct (pulmonary) transferred | 2 |
| Urinary retention (more than 1 day postoperative) | |

men was again opened up. At the second operation a few drops of pus were found in the suture line of the duodenal stump and the duodenum at the anastomosis was covered over by the omentum. An anterior gastro-enterostomy with entero-anastomosis was performed and drainage was given to the duodenal stump. The second day after operation intestinal contents appeared in the drainage opening. The wound was again opened and the opening in the duodenum sutured. The patient died 5 days after the third operation. Postmortem examination showed pneumonia, subphrenic abscess and insufficiency of the suture lines in the duodenal stump and in the gastroduodenal anastomosis.

CASE 3. Patient, aged 28 years, had a Billroth No. 2 operation done under ether anesthesia for ulcer duodeni. Patient complained continuously of pain after the operation and was again operated upon on the ninth day after the first operation when a strangulated ileus was found. The efferent and afferent jejunal loop had been strangulated by the opening in the mesocolon. At postmortem examination general peritonitis was found.

CASE 4. A Billroth No. 2 operation was performed under ether anesthesia upon a patient aged 53 years who suffered from ulcer duodeni. Symptoms of peritonitis appeared and a second operation was done 2 days after the first. Small abscesses were found in every suture hole. At postmortem examination general peritonitis was found.

CASE 5. A Billroth No. 2 operation was performed upon a patient aged 42 years for the relief of an ulcer ventriculi. The operation was done under ether anesthesia. Signs of severe peritonitis appeared on the following day and necessitated a second laparotomy. Perforation was found at the time through part of the ulcer which had not been removed. General peritonitis was determined at postmortem.

CASE 6. A Billroth No. 2 operation was performed under ether anesthesia upon a patient aged 45 years who suffered from an ulcer ventriculi. Signs of tenosis appeared after the sixth day. On the tenth day laparotomy was again performed. The anastomosis was found adherent to the liver and was very oedematous. An anterior gastro-enterostomy with entero-anastomosis was performed. Death followed 4 days later. Lobal pneumonia was determined at postmortem examination.

Pneumonia plays a leading role again this time as a factor complicating the postoperative course. The major complications observed are tabulated in Table V.

Those cases which presented unusual features are given in brief.

CASE 7. Under ether anesthesia a Billroth No. 2 operation was performed for ulcer ventriculi. Because of the appearance of symptoms of ileus the abdomen was

gain opened up and an entero-anastomosis was performed between the loops of the previous retrocolic anastomosis. The wound healed by granulation. The patient also developed severe bronchitis and pleurisy but after 3 months in the hospital was discharged cured.

CASE 8. A patient aged 24 years had a duodenal ulcer for which an infrapyloric Billroth No. 2 was done. The patient vomited daily and 5 days after operation because of his generally poor condition he was operated upon again and an antro-gastro-entrostomy with enteric anastomosis being performed for security sake. The patient made a complete and rapid recovery.

CASE 9. Under nitrous oxide oxygen anesthesia a Billroth No. 2 operation was done upon a patient aged 63 years who was suffering from a duodenal ulcer. A pancreatic fistula appeared on the fourteenth day after operation and this was ultimately healed when the patient was discharged from the hospital.

CASE 10. Under the anesthesia Billroth No. 2 operation was performed upon a patient 4 years of age who was suffering from a duodenal ulcer. The case was complicated by mortality after removal of the operation and this condition was treated by means of lavage with 1000 cc of 1% nitrate solution and fractional injections of 1 cc of 1% solution of adrenaline with success. The abdomen was again opened and a gastro-entrostomy was performed. No perforating vessels were seen but profuse bleeding from the anastomosis was observed. The enteric anastomosis

was resutured with a running catgut suture and the abdomen was closed. One and one-half liters of saline was given at the close of the operation. The following night the patient was very weak and was given a 500 cc of 1% morphine solution blood transfusion. This was repeated again in 3 days. The patient was discharged cured.

CASE 11. A patient 30 years of age was operated upon under the anesthesia for duodenal ulcer. A Billroth No. 2 was done. A duodenal fistula appeared which was healed at the time of discharge.

CASE 12. An infrapyloric Billroth No. 2 was done upon a patient 20 years of age who had a duodenal ulcer. Because of symptoms of tenosis the patient was operated upon again a week later. There was a strangulation of the lower duodenal angle caused by mesenteric adhesions. The adhesions were separated and the abdomen was closed. A phrenic abscess was suspected 3 days later but was not found. The patient was discharged cured.

SUMMARY

In a series totalling 606 partial gastrectomies for peptic ulcer in the Eiselsberg clinic there were 33 deaths a mortality of 5.44 per cent in those cases surviving—573 in number—60 presented some more or less serious complication in the postoperative course.

THE CONDUCT OF LABOR IN THE DYSTOCIA DYSTROPHIA SYNDROME PATIENT

EDWARD LYMAN CORNELL M D F A C S CHICAGO

THE patient who presents a big problem for the obstetrician is the one at present most frequently overlooked by the general practitioner and the young obstetrician. She has been classed here under the term *dytoccia dystrophia syndrome*. Most textbooks devote only a meager paragraph or two to the discussion of this type of case; in fact, unless one looks carefully through the index he fails to find any reference. Yet my experience with this type of patient leads me to state that she presents many more problems in the management of her delivery than does the patient with a generally contracted or flat pelvis. This is chiefly because such cases are not recognized as pathological entities until too late except by trained obstetricians.

To this syndrome DeLee has applied the term *dytoccia dystrophia syndrome*. Welz has used the term *sporadic cretinism* while the term *dytrophia adiposogenitalis* has been rather loosely employed by other writers. The literature on the subject is limited. I have been able to find only a few references aside from those written by members of the Chicago Lying In Hospital staff. Welz, Loizeaux, Solomons and Taylor, A. B. Davis, Horner and Greenhill are among the few who have contributed to the subject. With the exception of the two latter, the remarks are confined to one or two paragraphs and nothing very definite is stated to guide the physician in the management of this difficult type of case during labor.

The term *dytoccia dystrophia syndrome* is probably as good a term as it is possible to employ. In Stedman's dictionary the terms are defined as follows: *Dytoccia*, difficult childbirth. It is called fetal or maternal according as the cause is in some abnormality of the fetus or in uterine inertia or some obstruction in the parturient canal. *Dytrophia* is defined as defective nutrition while *syndrome* means the aggregate of symptoms associated with any morbid process and constituting together the picture of the disease. I have not been able to find any term which better describes this type of patient than the one DeLee has given.

The *dytoccia dystrophia syndrome* is not confined to any particular race. I have seen cases in the white race of most nationalities with the possible exception of those of Southern Europe and

a number of cases in the colored race although here it is quite rare. Social status seems to bear no relation to the condition as it is found in private practice as well as in the charity clinics. It is not unusual to find the girls in the family of a similar type. On the other hand the patient may be an only child.

These patients not infrequently give a history of irregular menstruation. They may miss their periods for as long as a year or they may menstruate only three or four times a year. Dysmenorrhea is a common complaint. During married life there is a tendency toward varying degrees of sterility. It seems to be difficult for such a patient to become pregnant and yet on examination little or no pathology is found in the pelvis. In some patients quite the reverse is true, and I have had a few in whom there was no difficulty whatever either in menstruation or as to fecundity. Many complain of difficulties in sex life i. e. absence of libido, vaginismus, etc.

These patients present a rather striking appearance. They are short and abnormally stout; their height is usually around 5 feet and the weight varies from 150 pounds for the shorter group to 300 pounds for the taller. Face and cheeks are fat and neck short, all of which give the head a squatty appearance. The chest is broad, the arms short and fat, the abdomen plump with more or less of a fat apron, and the hips and legs well padded and heavy. The hips particularly attract the attention of the physician because they are so broad. On closer inspection of the extremities it is to be noted that the humerus and femur are not out of proportion but the other bones, both the long and short ones of the hands and feet, are shortened considerably. The hands present a stubby appearance where the second, third and fourth fingers are more or less of the same length and especially is this noticeable with the first and third fingers. It resembles a spade hand. The foot is short and presents a squatty appearance; the toes are short and fat. The wrists and ankles are heavy and thick. The measurement of the elbow to the wrist i. e. from the olecranon to the os lunatum is about 23 centimeters whereas in the average woman this measurement is 25 centimeters plus. All the bones are thicker and appear harder than do those in the average woman.

The pelvis usually presents little that is abnormal except that the bones are thicker. The external measurements are usually normal or above normal. In the latter case they may vary as much as 1 centimeter for each of the pelvic measurements. The Baudelocque diameter is usually about 20 to 21 although as in Case 1 it has been found to be larger due to the fat pad. One notices that it is somewhat difficult to outline the pelvic bones externally because of the firmness of the muscle structure and the amount of fat present. On internal examination the vagina may be short and present a sense of fullness as it is well padded with fat. These patients are usually highly sensitive to vaginal examination and it is rather difficult in many of them especially in the high grade type to outline the various structures of the pelvis with any degree of certainty. In a few of these patients before pregnancy I have noted that the uterus seems to be smaller than normal although it is not what we might term an infantile uterus. The pubic ramus are greatly thickened the perineum and the vaginal walls seem to lack the same degree of elasticity that is usually noted in the normal patient.

The skin is usually pale in color even in the negro race and in a few instances it has presented a pasty appearance such as one would expect to find with kidney disease. The blood count is seldom much below normal although as a rule the hemoglobin is slightly below 80 per cent. Occasionally the hair markings are similar to that found in the male although this is not necessarily a distinctive feature. On most of these women however there is considerable hair on the lower abdomen and a profusion on the escutcheon.

During pregnancy these women have many complaints which are minor in character but it requires considerable tact on the part of the attending physician to keep up their morale. Spotting in the first trimester is not uncommon. Abortions occur easily and somewhat more frequently than in the usual run of patients. They gain rapidly in weight often as much as 10 pounds a month in spite of dietary measures to control the gain.

These women are prone to toxemia of pregnancy especially in the ninth month and they not infrequently quickly develop eclampsia or eclampsioid. They nearly all go over term often as much as 2 weeks or more. They have large babies and it is to be noted that the baby's bones are harder than those of the average.

With the onset of labor things do not start out correctly. As one of my residents told me several

years ago they go into labor on the wrong foot. Usually the bag of waters ruptures before the onset of pain anywhere from a few hours to several days. When the contractions start they are very painful to the patient but they are not strong to the palpating hand. The interval between contractions is irregular and may remain so for many hours. The administration of quinine with or without castor oil not infrequently increases the painfulness of the contraction but does not affect its intensity so far as cervical dilatation is concerned. It seldom causes the pains to become regular. The morale of the patient is easily broken and she cries out bitterly with each contraction and unless one is familiar with this type of patient he is inclined to believe that he is dealing with a hysterical woman. This is quite to the contrary. These women do have considerable pain. It seems to me that they are hypersensitive and that we should not consider them as cases of hysteria in labor but should pity them because of their inability to withstand pain.

The baby presents in a cephalic posterior position with somewhat more than the usual amount of deflection. It remains thus throughout the labor or at best rotates to the transverse position. An anterior position is so rare that I cannot recall seeing one in the past 5 years.

The progress of labor is exceedingly slow and tedious. For the number of contractions that they have at least two other women and some times many more would be delivered. Not infrequently at the end of 24 hours of more or less active labor there is only 2 to 3 centimeters dilatation. Formerly it was my practice to use oxytocic drugs to stimulate the labor pains but I found that such medication merely increased the amount of pain without producing an appreciable amount of dilatation. The introduction of bags will secure dilatation up to 9 or 10 centimeters but the amount of suffering that these patients have with the bag in place in spite of the use of morphin and other analgesics is almost beyond mention.

Delivery from below has been accomplished by means of Dehriesen's incisions with rotation of the head usually from the transverse position and the application of mid forceps with a deep episiotomy and the extension of this episiotomy upward 2 or more centimeters. The baby is large and its head not infrequently badly marked with the forceps occasionally the blades cutting through the scalp. The baby is asphyxiated and needs considerable resuscitation or it may die during the course of its delivery or shortly thereafter from brain hemorrhage.

If an episiotomy has not been done the mother is badly lacerated the cervix is badly torn thus inviting sepsis which appears very readily in these patients

A B Davis has very aptly said of these patients 'In many of them if the pelvic delivery dilatation and incisions of the cervix and forceps are persisted in the operator does not usually look upon his completed work with pride If version is attempted too often the results are not good Many of them become unsafe for classical cesarean section unless it is done early, because of the reason of sepsis This type of case gives the high percentage of stillbirths, cerebral hemorrhages broken necks children in whom the heart continues to beat for an hour more or less and then it is impossible to start respirations or those who die soon after birth

The difficulty in forceps delivery does not come at the outlet of the pelvis but more often at the inlet or the midplane because the soft structures of the pelvis lack elasticity Thus we obtain these bad lacerations

In the borderline case of this type spontaneous delivery is rare However these borderline patients not infrequently go into labor promptly and continue to complete dilatation and then progress stops It becomes necessary to deliver them by low or mid forceps and even then it is surprising how much damage is done to the pelvic floor and vaginal canal

It is very unwise to attempt the induction of labor in these patients irrespective of the method employed It is my opinion that it is impossible to tell in advance whether or not these patients will go into labor promptly will continue in labor and will give the obstetrician a reasonable chance to deliver them from below Even with a rather extensive experience I am unable to answer these questions A few patients for whom I have predicted a tedious labor have delivered rather promptly while those in whom a prompt delivery was forecast have given considerable trouble

Breech presentation is the *bête noir* in this class of patients Fortunately I have had only a few External version before labor is almost impossible because of the excess of fat on the abdomen In fact breech presentation is seldom diagnosed until the patient is in labor To induce labor in these patients is to court disaster with a vengeance I always do a cesarean section on these women if they are near 35 years of age regardless of the degree of the dystocia dystrophia syndrome

The ideal management of the dystocia dystrophia syndrome patient consists in placing her in the hospital when she goes into labor and never

inducing labor by mechanical means even in the presence of toxæmia of pregnancy While it is true that an occasional case comes through nicely on mechanical induction it is so infrequent as to be negligible When the patient enters the hospital in labor everything possible should be done to keep up her morale while giving her a test of labor My procedure consists usually in the use of morphin, $\frac{1}{4}$ grain as soon as the patient presents evidence of becoming tired not when she is exhausted This is followed by a rectal instillation of ether and quinine 10 grains as recommended by Gwathmey If the patient does not progress after 18 to 24 hours of labor with relatively good contractions I have resorted almost invariably to the low cervical cesarean section During the progress of the trial labor I have been cautious in the number of rectal examinations No vaginal examinations are made One must watch these patients carefully for the appearance of Bandl's ring tetany or a thinning out of the lower uterine segment On the appearance of any of these signs labor should be terminated If the patient presents a moderate or severe grade of toxæmia of pregnancy it is advisable to terminate labor by cesarean section provided the child is viable It is understood of course that the proper medical treatment for the toxæmia has not been successful Cases with eclampsia do not do well under the Stroganoff treatment because the labor factor is still present and cannot be overcome

I do not feel that this is an abuse of cesarean section and I heartily agree with A B Davis who says 'would it not be better to foresee some of this and abuse cesarean section in more of these cases and do it early when it is comparatively safe for mother and child?

In the borderline patient young in years I give a test of labor provided I believe the baby to weigh 8 to 8½ pounds If progress is not satisfactory then I perform a cesarean section

After having witnessed the stormy recovery and after listening to the complaints of these women for several months after delivery on several occasions I must confess that I would rather decline to handle these cases if I could not resort to cesarean section in cases in which labor is not normal

If the woman goes into premature labor or if the baby should be small for any reason the labor may approach normal Usually however the first stage is protracted but the patient not infrequently delivers spontaneously or with low forceps Other factors being equal I always give them a long test of labor

The suggestions made for primiparae do not hold if any of these patients has delivered by a difficult forceps with lacerations. The subsequent labors are frequently comparatively rapid and spontaneous because vaginal resistance is gone.

I will cite just a few cases to demonstrate the course in these instances. The cases are not selected by any means; they are the usual run in obstetrics. Merely the essential details are noted.

CASE 1 M K No 772 3 ged 34 ye first re po t d Oct b 3 1929 Sh h d been m d 2 ye 7 L st men trul period was August 7 929 Sh wa 64 n he t l k ash nd we ghed 28 pound w th cloth g Blo d p u wa 152 8 Urn w neg t Pelv m surem nt 28 5 3 36 5 nd d agonal c njugat 2 It w n ted that he wa a typ al dy toc a dyster ph a ynd m

She nt d th hosp t l J uary 9 93 with mu h ord m nd sy t l blo d p ssure l 60 On t m bed h mpr ed and wa s nt horn n J uary 3 with bl d p u 48 1 On M h 3 h sh w d r album n Th ft until Ma ch 2 th urine w the sam d th high t bl od p u 156 On Ma h 2 th urin show d 1 lb man nd hyl ne ts Sh nt ed the h pt l M h h cau eth bag f wat rs h d rupt d 18 3 m Sh h d irregu r p ms all th t day O th m rning f th 2 st sh wa g n ca tor d nd qu n wh h d not nc s th p m gul r ry Bl d p w gradually c mb ng unt l t ch d 78 8 At 4 15 p m a 5 ntm ler bag was in cri d Th w pl d 19 45 p m Th p n w r st ng t 3 m n t 1 r v l She h d t ng pain all night At 6 m M h 2 9 centimet b g wa in el d at wh ch m th r w st all th ch Sh w g m m ph g f st The bag cam out 19 am The bl d p w tll h gh P ns w e irregu and alt t l t g nd we k Th y rema n d th t way all n ht N p g s was made all the next m rning A th p t t pul e te wa n re ung and she wa be mu g ch ted d h r y w d ne cc d ng to the f ll wing t hn que Cervix thick 8 ntm t Disebr n n s n occupit l f post n r manual tati n to oc p t l t trans re ppl t to d f p and f ther t t n then st ng tra t n with the d h v ry f a 775 g m boy The h d w mu h m l d w th a l g p t The p e n um w s ved by a deep left m d l t al p o t my but the vagina h d a d p ext n on b the p sot my w und Th cut d h ry took s h rs Blood r ur w 5 Th m th mad a g od ec ry th h gh t temperatu be ng d g on 3 c ascut d ys She l f th h p al w th blood pres ure f 38 nd t r album n th n The tim from th ruptu e f th bag of waters unt l d l ry wa 29 h rs

Here then is a patient who went into labor at the beginning of the eighth month with a small baby and had a very tedious time. It demonstrates clearly that drugs and mechanical means of inducing dilation of the cervix do not work satisfactorily in these patients. One hesitates to do a cesarean section on a premature baby but certainly the fear and tear on both the physician and patient would justify it occasionally. It will be noted that this woman was 34 years old. The

Baudelocque diameter was 25. This is unusually large but it was due to the pad of fat over the sacrum and pubis.

The staff man in charge of this patient stated after delivery that had he known the difficulties to be overcome he would have done a cesarean section at the time he decided to insert the first bag. In this I would agree.

CASE 2 M L privat p t nt No 2590 ged 23 years ep ted Augu t 19 9 Sh had b en marr d 5 years nd n pt of many ttempts had n e bec me p guant H r h ht wa 61 inch nd weight 18 p nd h th tak n with cl thes n Her last m trual p nod w s April 4 9 9 General exam n t n w ng t P l m asures were p n u 24 1/2 nt c r tal 25 1 n ex 32 Baud locque 9 1/2 dag n f cony gat 12 Bl od p ur w 16-80

On September 15 she nte d th h sp t l with gas f th at ned b t n d gm ed f om occas al pain with blo dy vaginal discha g R t m bed le d thus up nd h w nt hom in f w day On O to b 23 sh re p t d with thru h f the gas wh ch assted the time t until J uary 9 1930 wh n t wa u d At this v t sh c explain d e ly f an tch ng dermatosis which was d gm ed t c r a h du t p gnay Sh had gain d mu h n weight n w 172 p unds Blood p es ur w 5 9 Th r a h rsted l l n s f t m at sug ge d by m y l and d m t logist

Fe m th men trul d ate w tmat d th t sh wa d e J uary 2 Sh f l th b by S ptembe 7 nd w uld b du F bru ry 8 Sh b g n lab F hu ry 1 930 t 12 m w th p m The pan we w k nd t minute nt r v ls Quinn 5 g ms w given at 9 m At this time the wa no dilat n and nly p mal d m nt f the rxv The h ad wa t engaged al th gh fixed Th p n n was c put left poster At mada ght th r v l w s dilat d 3 centimet rs d the p ns w re mod ate omng very 3 t 4 minut At th tm morph n sulphat / g an and a cub e t i met rs f 5 p cent m gm um sulphat w p n hypod mically foll wed by the Gwathrey ectal n illation Pati n th b d som r t nd at 9 am th f llow ng m ang sh had 3 centim ters d latu naft having h d t ng pain v ry to 3 minutes for 5 h urt Sh w b g nung to show s g n f e h us t a to a laparosc chel t my w s done under local nar th sia ne b If per cent n o cam be ng u ed Th op ratu n w asly c mply h d b by b y was b m ghung 4 2 gram

This p t nt w n labor fo 35 1/2 h urs She made a p mpt ec ry th highest temperatu e b ng 100 d g res on the ec ad day No complic ti n w re en count red

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EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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NOVEMBER 1931

ART AND PERSONALITY IN SURGERY

IN speaking of art, it is not my purpose to confuse it with handicraft in surgery. Surgeons have gone about as far as possible in this respect. Advancement must be made in other lines. When my assistantship to a great surgeon was finished, he gave me this parting admonition: 'Seventy-five per cent of your ultimate success in life will depend upon your ability to handle people; twenty-five per cent on your knowledge of medicine. Try to excel in both.' Reduced to its simplest terms, art and personality in the practice of surgery consists of the ability to understand and deal with people as human beings and not alone with their diseases.

Recently there has been much discussion of a feeling of dissatisfaction among physicians and patients. The paths of thought of physicians and laymen, especially the more informed laymen, have diverged; they are no longer thinking along the same lines. Among other things, patients are seeking relief and we as physicians are seeking information.

This rift being not only intellectual but temperamental, tends to prevent that human understanding so necessary to a complete evaluation of the patient and that human touch which is so essential if we are to be healers of the diseased body and mind and not mere craftsmen employed to repair an injured organ or to remove infected tissue.

This state of affairs is probably due to our critical and analytical manner of thinking. Each man in the profession has cut out for himself a segment from biology and is working therein with astonishing industry and acuteness of intellect without regard for a visualization of the subject as a whole. The physician of today who thinks only anatomically, chemically or physiologically cannot understand the patient before him. He is unable to perceive the manifest symptoms in their proper relationship or to recognize all the forces at work to injure or to benefit the patient. In this analytic age it is almost impossible even to apprehend the spirit in which the great physician Hufeland said: 'Every patient is a temple of nature. Approach him with reverence. It seems that our artistic or synthetic capacities have not kept pace with our analytic activities. In this endless chain of disintegrating effort we have all but lost sight of the fact that originally there must have been something to bind the parts of man together.'

An artist may be described as one who is able to build up from scattered fragments a recognizable unity. In the field of medicine and surgery this unity, this completed work of art, may be a satisfactory diagnosis, an adequate plan of treatment, a rehabilitated patient.

Let us now turn to personality. It is difficult to analyze this quality. We might say that it consists of character, intellect, will, and feeling, with a physical vehicle having peculiarities of its own. These factors, however, will remain inert until there has been added that something which quite defies definition, the power to make an impression upon the soul of another.

What is this soul so susceptible to the power of personality? I would call it the unifying principle of the organism, that invisible presence, the agitation of which may be noted in every system of the body. When it is perturbed, the muscles become tense, the eyes sparkle, respiration and heart action quicken, the face flushes, and the entire body response is evident.

When and how is the surgeon to use his personality as a therapeutic agent? He should use it without interruption from the patient's first visit to the time when he is fully prepared mentally as well as physically to return to normal life. As he zealously guards against unnecessary trauma to the tissues, he should in like manner safeguard the patient's psyche in the consulting room. At that moment the soul lies open and exposed to injury from incautious comment dropped by the surgeon or his assistants. It is already traumatized by the suspense and fear incident to the visit. The wise physician will immediately assuage this unhappy condition and protect the patient from further disturbance by the therapeutic power of his personality.

We cannot excuse ourselves by saying we have nothing to do with the patient's mind; that we are not psychiatrists but surgeons and have agreed to look only after his body. The matter is not so simple. The physical and the psychical are so interwoven that no one can say, "Here the physical ends, there the psychical begins."

The physician or surgeon must carry the patient on through all those events which transpire from the first visit to the final consummation of the whole transaction. The operation, although the most dramatic, but one incident, said Moynihan, "The postoperative course may be interrupted by unforeseen complications." Suffering often wears heavily on the patient, long days and sleepless nights play havoc with his reserve nerve force. He needs all the help that can be afforded him at such a time. Herein lies the opportunity for the surgeon to apply his power of personality to the greatest advantage. Such a personal influence must be a constant encouragement, never ceasing until the victory is won and the patient is returned again to his family and his business.

The surgeon who serves best and profits most is he who has been able to include in his training that artistic element of understanding which permits him to separate the essentials from the non-essentials, and who has developed and guided a hopeful and pleasing personality to the beneficent end that his patients may be restored to health.

R. L. SANDERS

TREATMENT OF ACUTE CRANIOCEREBRAL INJURIES

IN the treatment of acute craniocerebral injuries one is concerned with the injury to the brain. Therapy as regards cranial injuries is indicated only when the lesion is a compound or depressed fracture. A fracture of the skull *per se* unless of one of the two mentioned types may be totally disregarded in the treatment of acute craniocerebral injuries. Within the past decade the treatment of acute craniocerebral injuries has become largely that of conservatism. Prior to this time the operative treatment was employed in from 20 to 30 per cent of all cases.

whereas at the present time probably less than 5 per cent of all cases of acute craniocerebral injury are subjected to operative intervention. It is now generally accepted that conservative treatment is not only less dangerous but also more efficacious than the operative treatment in the majority of cases of craniocerebral injury, at least in those cases with no localizing signs. The conservative treatment of craniocerebral injuries is largely dependent upon the comparatively recently appreciated fact that the most frequent cerebral lesion subsequent to a head trauma is an oedema of the brain substance. As shown by the pioneer work of Weed and McKibben, cerebral oedema can be very effectively treated by the intravenous introduction of hypertonic solutions and upon this fact is based the modern treatment of acute craniocerebral injuries.

As in all other major traumas, acute craniocerebral injuries are frequently associated with surgical shock and it is therefore of utmost importance that shock should first be treated. The usual methods such as lowering the head, the application of heat to the body, and intravenous infusions should be used. Ideally, as advocated by Fay and Thomas, hypertonic (50 per cent) glucose solution should be used for the infusion. Fay has rightly warned against the use of magnesium sulphate during the period of shock, in that further dehydration of the body is undesirable.

The treatment of a case of acute craniocerebral injury without a knowledge of the cerebrospinal fluid pressure is more or less haphazard. Every patient with a major head injury should be given the advantage of lumbar puncture with the manometric determination of the cerebrospinal fluid pressure. In those cases in which there is a cerebrospinal fluid hypertension it is advisable to relieve the increase in pressure by slowly and cautiously removing some of the cerebrospinal fluid.

This can be accomplished safely by the gradual escape of enough cerebrospinal fluid to reduce excessive pressure above 10 millimeters of mercury by one half, i.e. if the cerebrospinal fluid pressure is 20 millimeters of mercury, enough fluid should be withdrawn to reduce the pressure to 15 millimeters of mercury. Lumbar drainage is especially indicated in those cases in which blood is present in the cerebrospinal fluid, as has been shown by the researches of Bagley.

As mentioned above, the increased intracranial tension due to cerebral oedema is best controlled by the use of hypertonic solutions. The intravenous injection of hypertonic solutions, especially 50 per cent glucose, is most efficacious. Hypertonic solutions of sodium chloride, as first advocated by Weed and McKibben, should not be used because sodium chloride being a dialyzable salt is absorbed and leads to secondary tissue retention with a rapid return of symptoms due to an increased oedema. The administration of magnesium sulphate, either by mouth or by rectum, is to be highly recommended. Fay has demonstrated that magnesium sulphate is about twice as efficient as sodium chloride when used as a dehydrating agent in the intestines. In the dehydration therapy, it is essential that the fluid intake must be limited and probably should not exceed 500 to 600 cubic centimeters in 24 hours. It is important, however, that over dehydration should be prevented. Lenche in 1920 emphasized that relatively infrequently in acute craniocerebral injuries there may be an associated hypotension of the cerebrospinal fluid pressure rather than a hypertension. In such cases Lenche and others have advocated and have successfully employed intravenous injections of sterile distilled water or of hypotonic solutions.

The operative treatment of craniocerebral

injuries is indicated in a relatively small number of cases which may be grouped as follows (1) scalp wounds (2) compound fractures (3) localized hæmatoma especially from the middle meningeal artery and (4) occasionally in depressed fractures of the skull. In the first two groups i.e. scalp wounds and compound fractures thorough debridement followed by primary suture should be done. In the second group craniotomy with evacuation of the blood clot is indicated and in the third group

in which there is pressure on the cerebral substance elevation of the depressed fragments should be performed. The operative treatment of acute craniocerebral injuries occupies a relatively small part of the treatment and it should be stressed that the conservative treatment especially the use of hypertonic solutions both intravenously by way of the alimentary tract as well as repeated lumbar taps are the methods of choice.

ALTON OCHSNER



William B. Osborn

MEMOIRS

JOHN BLAIR DEAVER

Born July 25 1855—Died September 25 1931

IN the death of John Blair Deaver the medical and surgical world and thousands of grateful patients throughout the land mourn the loss of a master surgeon I doubt if the passing of any surgeon of our time has created a greater void and deeper regret

This enthusiastic statesman of surgery was a star operator and early achieved international fame He loved his chosen work which he pursued with great industry and without signs of weakening to the age of seventy five The surgeons of every land, when they visit Philadelphia in the future will miss this genial host with his philosophy his irrepressible humor his diagnostic skill and his marvelous technique

The American College of Surgeons and its official journal—*SURGERY GYNECOLOGY AND OBSTETRICS*—have lost a great friend Dr Deaver was a Founder of the College a member of its Board of Governors since 1913 a Regent and President 1921 to 1922 He was a generous contributor to the journal Among his last contributions to surgical literature is his article on The Common Bile Duct which appears elsewhere in this issue of the journal Like all great men he was never too busy to do a thing that was worth while and it is typical of the man that within thirty six hours of his death he was busy correcting and editing papers which he planned to present before medical groups

Though he has departed from our midst, there are hundreds of active surgeons who were his students and whose skill commemorates the teachings of Deaver and from his publications future generations of surgeons will gain practical knowledge and inspiration for all time to come

FRANKLIN H. MARTIN

JOHN BLAIR DEAVER was born near Buck Lancaster County Pennsylvania, on July 25 1855 His father Joshua Montgomery Deaver was a famous country doctor of Lancaster County Dr Deaver is survived by his widow Caroline Randall Deaver a son Dr J Montgomery Deaver and two daughters Mrs George G Thomson (Elizabeth Deaver) and Mrs Emory G Alexander (Harriet Deaver) Dr Harry Clay Deaver a brother also a surgeon of renown in Philadelphia died June 25 1931

Doctor Deaver received his early education at the Nottingham Academy near his childhood home and was graduated from the University of Pennsylvania Medical School in 1878 He was resident physician in Germantown Hospital and for an additional year served as interne at the Children's Hospital entered the active practice of medicine in 1880 with offices at 16th and Vine Streets

Philadelphia Shortly thereafter he was appointed assistant demonstrator of anatomy in the University of Pennsylvania which title he held until 1883 demonstrator of anatomy 1884 to 1887 demonstrator of anatomy and lecturer on topographical anatomy 1887 to 1891 assistant professor of applied anatomy 1891 to 1899 professor of the practice of surgery 1911 to 1918 John Rhea Barton professor of surgery 1918 to 19 (Because of his wonderful skill and popularity the retirement age of sixty five years for professors at the University of Pennsylvania was extended for one year in Doctor Deaver's behalf) John Rhea Barton emeritus professor of surgery 1922 until his death on September 25 1931

In March 1918 Doctor Deaver was appointed professor of surgery in the Graduate School of Medicine of the University of Pennsylvania and in July 1931 he became emeritus professor of surgery From 1886 until his death Doctor Deaver was chief surgeon of the Iankenau Hospital

Doctor Deaver was a member of the American College of Surgeons American Surgical Association American Medical Association Interstate Postgraduate Medical Association of North America Southern Surgical and Gynecological Society Philadelphia County Medical Society Medical Club of Philadelphia College of Physicians and Surgeons of Philadelphia Philadelphia Academy of Surgery Philadelphia Obstetrical Society Northern Medical Association of Philadelphia and the J. Attkin Meigs Medical Association

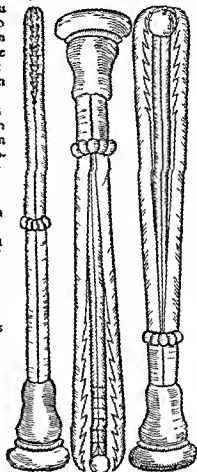
The John B. Deaver Surgical Society an honorary organization in the Medical School of the University of Pennsylvania is comprised of students who are particularly interested and adept in surgery This society is unique in that it is probably the only one that has continued after the person for whom it was named ceased his active connection with the University

Among the books of which Doctor Deaver was the author are *Appendicitis The Breast Its Anomalies Its Diseases and Their Treatment Surgery of the Upper Abdomen* (1st and 2nd editions) *Enlargement of the Prostate Its History Anatomy Etiology Pathology Clinical Causes Symptoms Diagnosis Prognosis Treatment Technique of Operations and After Treatment* (1st and 2nd editions) *Surgical Anatomy of the Human Body* (three volumes) *Excursions into Surgical Subjects* (collected papers)

The list of articles which he contributed to medical journals totals 248 many of which have appeared from time to time in SURGERY GYNECOLOGY AND OBSTETRICS

ALPHONSINVM

Non inuoluenda
 ramentis sicutio
 est grunum rostrum
 (vt vocant) vt pote
 quod & ipsum ad ex
 trahendum instrumen
 tum est excellentissi
 mum atque ab omni
 bus tu veteribus tum
 recentioribus comen
 datum quo non so
 lum pilulae & dillie illi
 mis locis sed & alia
 vt armorum vt cere
 sarum serum frustula
 extrahitur Huic nos
 vt commodius manu
 ac valentius tenere pos
 sit atq; itaq; de acci
 tera extranea n vul
 nere certius explora
 ss annulos forpicula
 sum modo adijcimus
 hoc pacto



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OLD MASTERPIECES IN SURGERY

ALFRED BROWN MD FACS OMAHA

ALPHONSO FERRI—CONCERNING THE TREATMENT OF GUNSHOT WOUNDS

LACK of knowledge of the details of a man's life sometimes makes it difficult to learn important things that should be known if one is to understand how to fit facts together and get at the fundamental reasons for events. The case of Alphonso Ferri is one in which this is exemplified almost perfectly. He is known as a personal physician to a Pope Paul III and so far as is known spent most of his life teaching surgery in Naples and Rome. This would make him a surgeon of civil life but he wrote one of the best books on the surgery of gunshot wounds of the period. He says in the introduction to his book that he is going to describe the cures and remedies which we know to be the best after much study the greatest diligence and long use both at home and in war. This makes one believe he must have been a war surgeon. In another place when writing of gunpowder he states that he had the opportunity to study its effects in Hungary and Campania and at the siege of Landrecies when in 1543 Charles V captured it from the French. That of course places him in the army in 1543 but in what capacity he does not say, nor does he or any record give us other data concerning his war record. We must then be satisfied in knowing that Ferri though a physician to the Pope and his court was at times a war surgeon.

Ferri was born at Faenza or Naples about 1500. Where he gained his early knowledge of surgery he does not tell us and the first known of him is that he was teaching surgery in Naples when he was called to Rome by Paul III to become his physician in ordinary. During some of his years in Rome he taught surgery and specialized in it to a great extent except that he wrote two books besides his book on wounds one having to do with the medicinal value of the sacred wood (Guaiac) and the other with the caruncles or calluses which arise in the neck of the bladder. In both these subjects he might have obtained considerable experience in his practice among the nobles at the papal court.

Much of Ferri's advice concerning the treatment of wounds coincides with that of the ancient authors. He quotes Hippocrates, Galen and Celsus of the ancient schools and the major Arabists such as Rhazes, Avicenna, Alhucasis and others. He believes that gunshot wounds are all poisoned by

the missile and advises removal of the bullet for which purpose he has devised a forceps which he calls the *Alphonsinum*. His canons or rules do not differ very much from present day teaching.

1 To seek for and draw out the lead ball and whatever has been carried in with it.

2 To manipulate the instrument that the drawing out may be most easily accomplished.

3 To destroy the poison with special medicaments.

4 To combat the crushing so that through it corruption of the part will not be hastened.

5 To remove completely all loose pieces of bone.

6 To replace the remaining pieces of bone in proper relation to the muscles and tendons so that the extremity can lay quiet.

7 To prevent suppuration.

8 To treat the wound with greatest care in all its stages so that evil chance may not befall.

Ferri advises searching the wound with the finger or sound to locate the projectile and loose pieces of bone if the wound is large enough. If it is small and sinuous he uses various types of flexible probes or sounds and then uses his *Alphonsinum* to draw out foreign bodies. For his dressings he uses all kinds of medicines following the usual ideas of the time. The search for the ideal wound antiseptic and healer was then going on and each expert differed with the other. Ferri rather withdraws from the controversy by mentioning nearly everything and playing practically no favorites.

For hemorrhage Ferri advises first the use of various styptic and clotting agents. If these do not work he then packs the wound with tampons covered with various medicaments and only if this fails does he stitch the vessel using a long needle curved at the end which carries a thread through the eye at its base which is placed around the vessel and the vessel ligated. If the wound suppurates Ferri advises the use of drainage tubes.

Ferri's book on the caruncle or callus of the neck of the bladder which is printed with the 1583 edition of his book on wounds is extremely interesting. Reading between the lines he comes very near describing many of the growths of the bladder including enlargement of the prostate. A quotation will suffice to give the idea. He describes the caruncle as occurring in the following forms: Simple soft hard fungous with a heavy white covering warty porous. Ferri deserves the title of the first to describe bladder pathology.

tation of the injured. The injuries of the various regions of the body are considered separately. The sections on fractures and hernia are particularly interesting. The reviewer feels that this excellent book should be in the hands of all men dealing with industrial injuries.

FRE ERICK CHRISTOPHER

IN the introduction to his book on roentgen technique Block states that his work is not for the trained roentgenologist but rather for the technician and physician doing occasional X ray work. The book takes up elementary problems in physics such as milliamperes ohms and volts electromagnetism induction transformers etc. He gives a thorough discussion on the physics of rays X ray tubes and measuring instruments. He includes a complete chapter on the various types of X ray equipment used in Germany with comparative tables of maximum output and load of these types of machines but this is of little value to anyone in this country. The book contains a discussion of electrical accidents and a paragraph on resuscitation. The book is well

written although there is very little in it that is new and is practically limited to home consumption.

ROBERT A ARENS

FOR the aid of the man doing roentgen therapy with limited equipment particularly the roentgen apparatus Erskine has written an interesting book. He does all his treatments with three techniques thereby simplifying the work considerably but adds a fourth technique for those who have 200 kilovolt equipment. The chapters on physics are clear and concise and it is refreshing to see the absence of complicated formulae. All his work is measured by the universal R unit. He describes various measuring instruments and gives their good qualities as well as calls attention to their shortcomings. The book contains 24 excellent illustrations including curves and tables. The conditions suitable for X ray treatment are divided into three sections: skin non-malignant and malignant conditions. The author does not claim to include all possible diseases that can be treated by X ray.

ROBERT A ARENS

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SURGICAL OPERATIONS AND ASSOCIATED INFECTIONS AS POSSIBLE ETIOLOGICAL FACTORS IN THE DEVELOPMENT OF EXOPHTHALMIC GOITER AND OF HYPERTHYROIDISM FROM ADENOMATOUS GOITER

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THROUGHOUT the literature acute and focal infections fright worry physical and mental strain and trauma are referred to as possible etiological factors of exophthalmic goiter or of hyperthyroidism from adenomatous goiter. It is probably the consensus of opinion that these factors are non specific in effect that they act rather as precipitating or aggravating agents if subjects are otherwise predisposed. Chronic cholecystitis, chronic appendicitis, dental infection and infection of the urinary tract also have been thought to play a part in the etiology. Foci of infection particularly in the tonsils have frequently been incriminated. It has been our experience that patients with exophthalmic goiter are prone to have tonsils from which fluid pus can be expressed. It has been our impression however that the tendency to attacks of acute tonsillitis, which seems to exist in cases of exophthalmic goiter usually has developed after the onset of the exophthalmic goiter rather than preceding it. In cases in which the onset of symptoms of exophthalmic goiter dates to an attack of acute tonsillitis careful questioning of the patient often will reveal a history indicating the presence of the disease in a mild degree

previous to the onset of tonsillitis. Such a history may not be one of failing health but of an unusual sense of well being possibly associated with an abnormally good appetite and gain in weight, or it may include a statement that the patient was unusually tolerant to cold requiring fewer bed coverings and so forth for a period of time.

Neither the high incidence of tonsils which appear to be chronically infected nor the history of increased frequency of acute tonsillitis necessarily indicates that tonsillar infection is an etiological factor in exophthalmic goiter. Undoubtedly the appearance of the tonsils is influenced by exophthalmic goiter. Usually in exophthalmic goiter there is hypertrophy of all lymphoid structures in the body including the tonsils. Furthermore the quantity of secretion which can be expressed from the tonsils in cases of exophthalmic goiter may be influenced by circulatory changes which are associated with the disease.

Csepai¹ in connection with his work at the University Hospital at Budapest reported an observation which tends to support our opinion that exophthalmic goiter renders a patient more susceptible to the development

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of acute tonsillitis. In a certain ward in which there were 11 patients this observation was made. Four of the patients had exophthalmic goiter and 1 patient had so called iodine hyperthyroidism the other patients had various chronic diseases. One of the patients who had exophthalmic goiter also had erysipelas at the time of admission. Within a few days all of the patients who had exophthalmic goiter and the patient who had iodine hyperthyroidism had acute follicular tonsillitis. The other patients in the ward did not contract tonsillitis. The patients who had exophthalmic goiter had been distributed throughout the ward and had received the same nursing care given to the others.

We feel that there is evidence of etiological relationship between acute or focal infectious processes and the development of exophthalmic goiter or hyperthyroidism from adenomatous goiter but we realize that this is not definitely established. On the contrary it is possible that these diseases may activate certain chronic infectious processes or render the patient more susceptible to the development of certain acute infections as tonsillitis.

The relationship of infection nervous shock and trauma to the development of exophthalmic goiter or of hyperthyroidism from adenomatous goiter is an intriguing subject but it is one in which it is difficult to obtain accurate data for dependence must be placed almost wholly on case histories for evidence as to the time of onset of these diseases of the thyroid gland. Therefore evidence gained from this source relative to contributing factors will be incomplete and presumptive.

It occurred to us that possibly there may be associated with many abdominal and other major operations one or more of the factors which are considered to be aggravating or precipitating in the development of exophthalmic goiter and of hyperthyroidism from adenomatous goiter such as infections nervous shock and trauma. The actual time of onset of exophthalmic goiter or of hyperthyroidism from adenomatous goiter is more subject to proof in the cases in which toxic symptoms of goiter have dated from some general surgical procedure than it is in cases in which the symptoms have dated from some

acute infection or traumatic shock. This is because data obtained from general and laboratory examination just previous to operation are available for study. These data may be particularly valuable in those cases of nodular adenomatous goiter without symptoms of hyperthyroidism in which the basal metabolic rate has been studied as a precautionary method before proceeding with some abdominal or other operation not related to the thyroid gland. Associated with major operations are the infections caused by operative trauma and the acute and chronic infectious processes for which many operations are performed such as cholecystitis and appendicitis and the postoperative complicating infections such as pneumonia. It is also possible that there may be sufficient worry fear or trauma associated with a major operation to constitute a factor in the aggravation or precipitation of exophthalmic goiter or of hyperthyroidism from adenomatous goiter.

This paper is not presented as a statistical report but as a review of a few isolated cases in which evidence suggested that a major operation or factors associated with it precipitated or aggravated exophthalmic goiter or hyperthyroidism from adenomatous goiter.

In a search for illustrative cases we reviewed the records of 38 cases 3 consecutive cases of exophthalmic goiter and 15 consecutive cases of adenomatous goiter with hyperthyroidism in which partial thyroidectomy had been performed in The Mayo Clinic and in which a previous surgical operation not of the thyroid gland had been performed also in the clinic. The operations not related to the thyroid gland had been performed from several weeks to several years previous to the thyroidectomy. A number of these operations was minor.

In 19 of the group of 23 cases sufficient time had intervened between the surgical procedure and the onset of symptoms of exophthalmic goiter to enable us to rule out the possibility of any relationship between the operation and the onset of the toxic symptoms of goiter. In 2 cases the symptoms of exophthalmic goiter had apparently developed about the time of the major surgical operation but the evidence was rather circumstantial.

In 1 case the symptoms were first recognized during a postoperative reaction but after a careful review of the history it was obvious that the disease had been present for months. The remaining case (Case 1 of the series) is the first which we will present in detail. In 12 of the 15 cases of adenomatous goiter with hyperthyroidism sufficient time had elapsed between the operation and the development of the symptoms of hyperthyroidism to exclude any relationship between the two. There were 3 cases in which at least a coincidental relationship between the course of the hyperthyroidism and the major operation existed. In 1 of these cases hyperthyroidism was first recognized during severe postoperative reaction but careful questioning revealed evidence which indicated that hyperthyroidism had been present for some time previously. The 2 remaining cases in 1 of which nephrectomy was performed and in the other cholecystectomy will be reported in detail.

REPORT OF CASES

CASE 1. A woman aged 47 years had experienced acute abdominal pain 36 hours previous to registration at the clinic and 24 hours later the pain had localized in the right lower quadrant. There was a history of previous but less severe attacks at intervals. There were no symptoms except those related to the abdominal condition.

The blood pressure in millimeters of mercury was 160 systolic and 90 diastolic and the pulse rate was 120. The temperature was 101 degrees F and the leucocytes numbered 8,000 in each cubic millimeter of blood. A diagnosis of acute appendicitis was made. Appendectomy was performed and the surgeon reported an acute gangrenous appendix with rupture and no evidence of general peritonitis at the time of operation. The patient was dismissed from the hospital 1 day after the operation and from observation 5 days later.

Four and a half months later the patient returned. She had not regained weight following operation and 2½ months before her return more definite symptoms of exophthalmic goiter had begun to be evident. The basal metabolic rate was +46 and +4 per cent. There is nothing in the records of her case to indicate that the pulse had been considered unusually high for acute appendicitis during the period of hospitalization or that the patient had not had a normal convalescence following appendectomy. The unusually high postoperative pulse rate shown on the pulse and temperature charts however convinced us that the patient had exophthalmic goiter at the time she was dismissed from our care following appendectomy.

CASE 2. In this case an operation for goiter had been performed elsewhere in 1914. The patient had been well until 3 weeks previous to registration at the clinic when he had ureteral colic. A week later cystoscopy was performed and a stone was passed. He came to the clinic because of the fact that roentgenograms following cystoscopic examination showed that a large stone was still present. He appeared to be strong and healthy. He had lost 17 pounds during the month previous to his registering at the clinic.

The pulse rate was 88. The urine contained a great deal of pus. Right nephrectomy was done. Severe infection and a cortical abscess were found. Postoperatively there was a protracted febrile reaction and some fever persisted for 8 days. During this time the temperature was not below 100 degrees F and ranged from 100 to 101.6 degrees F. There was no unusual reaction of the pulse although the pulse rate possibly had averaged higher than is usually the case. The patient was dismissed from the hospital on the seventeenth day, 4 days previously the pulse rate had ranged from 80 to 95 but on the day of his admission to the hospital it had been 100. Fifteen days after dismissal from the hospital the basal metabolic rate was +44 per cent, the test was repeated and the rate was +50 per cent. Metabolism tests had been obtained because of the fact that in the period of postoperative convalescence while the patient was being seen daily for dressings the pulse rate had been running from 100 to 118 and the patient was unusually weak.

It is probable that this was an exophthalmic goiter. The patient had been operated on for goiter elsewhere in 1914 and the gland had proved to be of the type of colloid goiter in which cysts had formed and calcareous nodules were found at second thyroid operation. Compound solution of iodine had been administered for 8 days.

The loss of weight which occurred during the 3 or 4 weeks previous to the patient's registration is difficult to explain even though the renal colic occurred in this period. This fact together with pulse rates which ranged from 88 to 100 previous to the renal operation suggests that the hyperthyroidism may have been present before nephrectomy. Acute reaction after nephrectomy did not occur as indicated by the pulse and temperature chart and the absence of any nervous symptoms.

CASE 3. A woman aged 62 years came to the clinic in October 1926 complaining of pain in the stomach which had been present since the previous July. However she had had indigestion for 2 years. There had been similar intermittent pains in the right upper quadrant of the abdomen. For some

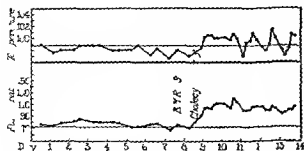


Fig. 1. Temperature and pulse just prior to and for the first 5 days following cholecystectomy. Case 3.

time she had had constant pain in the pit of the stomach and often this pain had become so severe that she had vomited. Taking of food evidently started the pain. The patient had had nothing but liquid food for a week previous to her admission. A nodular type of goiter had been present for 24 years. Roentgenograms of the heart and lungs did not reveal abnormality. There was no evidence of hyperthyroidism. The blood pressure was 140 systolic and 115 diastolic and the pulse rate was 72. A diagnosis of chronic cholecystitis was made and operation was advised. The patient was hospitalized for observation 8 days previous to the day for which operation was scheduled. The metabolicism as studied as a precautionary measure. The basal metabolic rate the day before operation was $+9$ per cent. In the absence of any clinical laboratory evidence of hyperthyroidism we felt that operation for the goiter could be postponed indefinitely. At the time of exploration for the cholecystitis the gall bladder was found to be mildly inflamed and to contain stones. The common bile duct was dilated and contained a tumor. Cholecystectomy was performed. The pathological reports subacute cholecystitis superimposed on chronic cholecystitis.

Records of pulse and temperature during the first 14 days of hospitalization are shown in Figure 1. The pulse rate, as normal previous to operation should be noted. During the last 3 of the 14 days data concerning the change are given in Figure 1 and

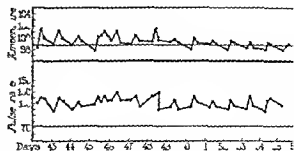


Fig. 2. Temperature and pulse following cholecystectomy about one month later than the period shown in Figure 1 and during the period just previous to the patient's dismissal from the hospital. Case 3.

beginning on the fourth day following operation a septic type of temperature developed and persisted for about 39 days. Records of the temperature and pulse for the period from and including the forty-third to fifty-sixth day of hospitalization are shown in Figure 2. It may be noted that in the last 5 days of this time the temperature was only occasionally above normal and then only slightly elevated. The pulse rate however continued to fluctuate between 100 and 110. The temperature was apparently the result of bronchopneumonia which terminated in bilateral bronchiectasis. The possibility of complicating hyperthyroidism was first considered on the thirteenth day after operation when the patient appeared to be somewhat stimulated. This occurred in the course of a period of unusual elevation in temperature however. The pulse rate at this time suggested hyperthyroidism. Unfortunately a basal metabolic rate was not obtained on patient's dismissal December 23, 1936.

The patient registered again on March 16, 1937. She stated that she had not regained weight or strength since the operation although she had had a good appetite. She had become increasingly tolerant to cold. There were still some cough and expectoration and roentgenograms still showed evidence of bilateral bronchiectasis. The basal metabolic rates were $+60$ and $+65$ per cent. Thyroidectomy was performed. The high pulse rate previous to thyroidectomy is shown in Figure 3. A comparison may be made of the pulse rate just previous to cholecystectomy (Fig. 1) at the time of the patient's dismissal following cholecystectomy (Fig. 2) and during hospitalization previous to thyroidectomy (Fig. 3).

Three of the 38 consecutive cases reviewed have been reported in detail as there was more evidence in the cases to indicate that one or more of the factors associated with a major operation were precipitating factors or at least aggravating factors in the development of exophthalmic goiter and hyperthyroidism from adenomatous goiter.

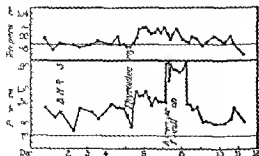


Fig. 3. Temperature and pulse before and after thyroidectomy. Case 3.

In Case 1 a pulse rate of 120 to 130 just previous to appendectomy for gangrenous appendicitis seemed out of proportion to the temperature and the pathological changes and suggests that exophthalmic goiter existed previous to operation. However disease of the thyroid gland must have developed in a period when the patient was harboring chronic acute and subacute infectious processes for chronic appendicitis with recurring acute attacks had existed for several months previous to the appendectomy.

In Case 2 the toxic symptoms of the goiter had developed rapidly during a 15 day period of convalescence following nephrectomy. There had been a febrile reaction lasting 8 days after the operation. However a loss of 17 pounds in weight during the month preceding nephrectomy suggests the possibility of hyperthyroidism having been present during that time. If so this period still corresponds with one in which chronic infectious processes were present as operation revealed infection in the kidney and a cortical abscess.

In Case 3 the evidence is clearly conclusive that hyperthyroidism from an adenomatous goiter developed during severe postoperative reaction and progressed to the time of the operation for goiter. In this case hyperthyroidism developed during the course of a severe pulmonary infection. Moreover this patient had been the subject of infectious processes for some time having had severe attacks referable to the gall bladder and at the time of operation subacute cholecystitis.

Admitting the possibility of a strictly coincidental relationship between the development of thyroid disease and the surgical operations with their associated factors one should not be criticized for considering the acute subacute and chronic infectious processes which were present in these cases as probably precipitating or at least aggravating factors in the development of exophthalmic goiter and hyperthyroidism from adenomatous goiter.

SUMMARY AND CONCLUSIONS

This review has strengthened the impression we have had for many years that in cases of exophthalmic goiter or hyperthyroidism from

adenomatous goiter in which the onset of symptoms was attributed to acute infection nervous shock or operation a critical review of the histories usually will indicate that the disease was present before the acute infection nervous shock or operation.

In the isolated cases in which the time of onset of the toxic symptoms of goiter coincides approximately with some major operation not of the thyroid gland the relationship may be coincidental.

Even in cases of exophthalmic goiter a disease which many observers believe is based on constitutional predisposition major operations and their associated factors such as acute and chronic infectious processes fear and trauma do not usually precipitate the disease.

The rare cases of exophthalmic goiter and of hyperthyroidism from an adenomatous goiter in which the symptoms have dated from some major operation involving a structure other than the thyroid gland probably offer a better opportunity for consideration of some of the factors often supposed to be of etiological significance particularly the infectious process than do those cases in which the symptoms have dated simply from some infectious process as tonsillitis or influenza.

In spite of the infrequency of cases in which the development of exophthalmic goiter and of hyperthyroidism from adenomatous goiter approximately coincides with that of some major operation not related to the thyroid gland and admitting the possibility of coincidental relationship we believe that the evidence obtained in the cases so far studied tends to support the contention frequently held that acute or chronic infectious processes are precipitating or aggravating factors in the development of exophthalmic goiter or of hyperthyroidism from adenomatous goiter if persons are predisposed to these diseases.

That infectious processes in the etiology of exophthalmic goiter affect the thyroid gland specifically or directly has never been proved. It is probably the consensus of opinion that they play an etiological role only in certain cases and then by lowering the resistance of the patient by exerting some unusual stimulation on the thyroid gland or in some other indirect non specific manner.

EXPERIMENTAL PERITONITIS

III THE EFFECT OF DRAINAGE UPON EXPERIMENTAL DIFFUSE PERITONITIS¹

J R BUCHBINDER M D F A C S W A DROEGEMUELLER AND F R HEILMAN M D CHICAGO
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In a previous study (2) we described a type of acute diffuse peritonitis in dogs similar to that of a perforative peritonitis in man. This lesion which is pathologically identical with human peritonitis we have adopted for a lethal standard. It is produced by leaving attached to its mesentery an open loop of lower ileum approximately 40 centimeters in length and re-establishing the continuity of the bowel by an end to end anastomosis the open loop being returned to the abdomen and the wound closed. In a series of 31 animals we found that this caused a mortality of 90.3 per cent 28 animals having a general peritonitis and 1 a large abscess.

This peritonitis differs from human peritonitis in one important respect only with great rarity does the dog develop paralytic ileus. This we believe is due to the relatively greater muscular development of dog bowel and to the fact that dog peritonitis is more exudative than human peritonitis. An abundant purulent exudate provides mechanical isolation of contiguous loops. The one dog in which we observed ileus had a dry peritonitis. We are not concerned with ileus in this study and so may disregard this difference. In every other respect the gross pathological picture of the two lesions appears to us to be identical. This statement applies also to the physical and microscopic characteristics of the exudate. This is not true in experimental peritonitis produced by intraperitoneal injections of suspensions of pyogenic organisms. We have not made careful studies of the bacteriology of peritonitis. The careful identification of the various types of bacteria found in peritoneal exudates has not been a necessary adjunct to those phases of this disease in which we have been interested.

EXPERIMENTAL WORK

In a series of 4 animals 33 are available for study 9 deaths being due to leaky anas-

tomosis evisceration obstruction and ether. In this series we re-opened the abdomen 24 hours after returning the open loop to the peritoneum and made a study of conditions therein. The small bowel of a dog with its relatively small lumen and thick musculature when perforated or cut across does not produce so rapid a contamination as does the small bowel of man. From our observations it requires approximately 24 hours of contamination from such a loop to produce a serious spreading peritonitis the same as that which would be found in the human 6 to 8 hours after a similar perforation. Our purpose was to determine what benefit if any could be expected by the removal of a septic focus in such spreading infections as almost uniformly lead to a fatal general peritonitis.

Fourteen of these animals or 42 per cent lived and were killed with ether at period ranging from 15 to 65 days after operation. There was no gross purulent exudate in any of the 14. We characterized the abdomen in this series as clinically clean. The numerous organized adhesions which in 3 of the series were dense bore out the assumption that the peritonitis from which this series had recovered was diffuse and not local. When a dog recovers spontaneously from a peritoneal abscess the abscess will persist a long time with the animal apparently healthy. We have opened such abscesses in previous series of experiments after 100 days or more. When we re-opened the abdomen of animals 24 hours after returning thereto the open loop the first observation made was that concerning the extent of the peritonitis. At this period (24 hours) this was never general except in those animals in which a leaky anastomosis was left. The zone of spreading infection involved about half of the peritoneum. Pelvis and diaphragm at this time were free from signs of infection. We emphasize this point because we believe that

general peritonitis is often fallaciously diagnosed in the presence of a diffuse but more or less limited infection. Whenever we found a general peritonitis it was either in a moribund animal or at autopsy.

Further observation on this spreading infection may be recorded. The intensity of reaction was greatest at the zone of soiling and diminished more or less radially as one left this zone. Smears made from the surfaces of bowel and omentum in the zone of spread were densely packed with pus cells and with bacteria. Smears made from loops distant from the zone of reaction and from the exudate in contact with these loops were densely packed with pus cells but always showed a marked diminution in the number of bacteria present. Smears of the exudate in portions of the peritoneum not yet inflamed such as the pelvis occasionally showed no organisms at all. We have found free loops of bowel covered with such an exudate without showing obvious pathological change. This represents the stage of contamination and we believe that the discovery of such an exudate at a distance from the zone of spread has erroneously led to the diagnosis of general peritonitis in man and was largely responsible for the now obsolete practice of multiple stab wounds for drainage. When the exudate is characterized by an abundance of fibrin the limits of spread are frequently sharply demarcated by fibrin deposits upon the bowel surface resembling ridges even though there be no encapsulation nor adhesions at these points. Fibrinous adhesions agglutinating contiguous surfaces during the period of active spread in other parts of the peritoneum represent local zones of recovery. In animals that have died of a general peritonitis when such adherent surfaces are separated and smears are made from such surfaces a definite diminution of both pus cells and bacteria is always shown and occasionally a complete absence of the latter.

Of the 19 deaths 5 were due to local peritonitis or abscess in contrast with only 1 case of localization in the 31 animals that were not reoperated upon. This point will be discussed later in connection with the problems of drainage. Of the 14 animals that died from

general peritonitis the average postoperative duration of life was $5\frac{1}{2}$ days while those that died from abscess lived an average of $7\frac{1}{2}$ days. From this we may assume that the removal of the septic focus of the 24 hour period decreased the virulence of the infection even in those animals that died of general peritonitis. The mortality of this series would probably have been lowered further had the animals with a abscess been reoperated upon.

In a second series of 20 animals the abdomen was re opened at the end of 24 hours of contamination from an open loop. The loop was removed at this time (24 hours) as was done in the previous series. Two drains of glove rubber about 5 centimeters in width were inserted through the same incision, 1 drain extending toward the pelvis the other toward the upper abdomen. Both drains crossed the vicinity of the original source of contamination and zone of spread and extended into zones where exudate was present but gross peritoneal changes were absent. We mention this point because we believe that too frequently the exudate rather than the pathological changes in the peritoneum constitutes an indication for drainage. The abdominal wall was closed rather loosely about the drains which were sutured into place. One of these animals died of hemorrhage from the cut end of the open loop, another died from an anesthetic during the second operation. This left 18 for study. The mortality of this series was 100 per cent. The average duration of life was a little over 4 days. Fifty per cent of these animals lived less than 3 days. Two animals lived 10 days or more. The cause of death in 17 of this series was a suppurative general peritonitis. One animal that died on the fourteenth day showed evidence of a general peritonitis that was subsiding the cause of death being bilateral streptococcus pneumonia.

At autopsy in every instance there was sufficient encapsulation of the drain to prevent its functioning as such. Drains in the lower half of the abdomen showed more complete encapsulation than those in the upper half due chiefly to the action of the omentum. Drains unfaulingly evoked more fibrin in their encapsulation than the perforative lesion

Drains evoked fibrin when there was no evidence of it elsewhere and in the presence of an exudate quite watery in its consistency. Multiple small residual abscesses occurred within the encapsulated drainage tract in 5 instances. Evacuation of these abscesses along the drain was prevented by filmy fibrinous adhesions to the drain. Fibrinous attachments to rubber are neither as extensive nor as firm as in the case of gauze but a very small amount of encapsulation of the drain is sufficient to interfere with its function. It has been our observation in experimental peritonitis that complete encapsulation of a soft rubber drain seldom occurs but a single slender band of fibrin prevents escape of exudate. Clinically we have no way of estimating the patency of a drain without re-opening the abdomen. Yates called attention to this point in studies on normal peritoneum and in mild peritonitis produced by intraperitoneal injections of bacteria.

In the 9 animals that died in less than 3 days the exudate was slight in amount none of them having more than 40 or 50 cubic centimeters with the exception of 1 which had a little over 100 cubic centimeters. Scantiness of exudate is quite characteristic of virulent infection and could not be attributed to loss of exudate along the drain.

In a series of 5 animals we increased the virulence of infection by producing a perforation of the terminal ileum. The perforation was approximately $\frac{1}{4}$ the lumen of the bowel which averaged about 1 centimeter. Such animals rarely lived more than 4 to 30 hours. 1 died in 17 or 18 hours. In the remaining 4 drains were inserted in the vicinity of the perforation. The dogs were killed with ether and re-opened 2 in 3 hours and in 4 hours after the insertion of the drains. All 4 showed encapsulation sufficient to prevent function of the drain as such although the animals were approximately within 6 hours from death with a virulent peritonitis. The exudate in all 4 animals was characterized by a scantiness of fibrin.

DEDUCTIONS

We shall not review the literature of drain age in peritonitis. It is voluminous, particu-

larly in the clinical phases. Methods too numerous to mention for draining the peritoneum have been suggested, tried out and abandoned. It would seem were it physically possible to do so that efficient drainage would offer possibilities in diffuse peritonitis. In an earlier study (1) in the normal and in moderately inflamed peritoneum we were able to keep tubular drains patent for more than 48 hours by the use of hypertonic dextrose solution. In a like manner we were able to prevent adhesions between inflamed contiguous loops of bowel by maintaining a transudate in the abdomen during the period of healing. Such a transudate prevents fibrin formation by dilution of the inflammatory exudate. In the presence of a virulent diffuse peritonitis of the type that we have been using a hypertonic dextrose solution fails to prevent encapsulation of the drain and mortality is markedly increased probably because of a more rapid diffusion of the infection.

Every medical student is taught that drainage of the peritoneum is physically impossible. However it is also true that drains are still used in diffuse peritonitis and that in death following such a lesion the tendency is to place the burden of responsibility upon the shoulders of the man who does not drain. This inconsistency between the well known experimental observations of numerous workers and clinical conceptions and treatment of this disease we believe is based on three factors: (1) there is still a difference of opinion as to duration of the effectiveness of a drain; (2) the idea is still prevalent that some types of drains are more effective than others; and (3) the operator's conception of the type and extent of the peritonitis with which he is dealing is often erroneous. Our experimental observations are opposed to the clinical observation of Hertzler who states

the more fluid the exudate the longer drainage will continue. In virulent infections where all efforts at adhesion formation are nullified drainage may continue for a long period. Other observers in both experimental and human peritonitis have expressed the opinion that in such forms of peritonitis drainage may be long continued. If any one fact in our work is worthy of emphasis it is

that the character of the exudate has no bearing on the effectiveness of the drain or its freedom from interference by encapsulation and that the drain is far more provocative of encapsulation than a perforation or other source of infection.

One cannot question the necessity for drainage in local peritonitis. Immobility of peritoneal viscera making up the wall of such an abscess prevents encapsulation in the same manner that it occurs in the presence of mobile peritoneal viscera. Quite frequently a larger than ordinary abscess the confines of which are not determined is mistaken for a general peritonitis and a cure of this condition is recorded. In a virulent and rapidly spreading diffuse peritonitis we believe that drains of any kind are not only useless but increase the degree of contamination and the rapidity of spread in territory beyond the zone of involvement. We believe that this is even more true in man whose peritoneum reacts to a lesser degree of soiling than does that of the dog. Clinically we know that a serious spreading peritonitis may be set up by the careless handling of a local process even when the contamination is no more than that of a finger or a tampon pushed into the free cavity.

One may readily extraperitonealize a zone of uninfamed or slightly inflamed peritoneum by a drain. In an impending fistulous tract leading to bowel or bile tracts such a maneuver is effective but in our experience with dog peritonitis a drain fails to extraperitonealize a zone of actively spreading peritonitis or to promote a flow of limiting plastic exudate about the zone of spread. In this connection Yates rather humorously states nothing is more perplexing than to determine just how the peritoneum distinguishes whether it is being walled off or drained. The drain will become encapsulated within the zone of spread but the intensity of the spread is apparently increased rather than inhibited by the drain. In human peritonitis of the spreading type clinical deductions as to the extent are frequently erroneous and no incision sufficiently large to establish the extent of the lesion is justified. The character of the exudate will often give an accurate clue as to the

extent of the lesion or at least to differentiate a well localized from a spreading process.

If we were to state the clinical application of our experimental observations we would say first that in a spreading peritonitis the focus should always be removed. Second that the removal of the exudate present at the time of operation is very important as resorption of a large amount of toxic exudate contributes greatly to the morbidity and to the mortality. Aspiration is the most satisfactory method of accomplishing this since it can be done completely without contamination of unsoiled territory and it cannot be done with a drain. Third we believe the abdomen should be closed and the abdominal wall down to the peritoneum drained to prevent phlegmon of fascial and subcutaneous spaces.

CONCLUSIONS

1. In an experimental severe spreading peritonitis such as follows bowel perforation and is accompanied by a mortality of over 90 per cent removal of the septic focus and closure of the abdominal wall reduces the mortality to 58 per cent.

The institution of soft rubber drainage in such an experimental lesion is followed by a mortality of 100 per cent.

3. The duration of the effectiveness of a drain is not modified by the character of the exudate. Prolonged drainage of an exudate thin in consistency appears to be impossible.

4. The mere presence of a purulent exudate at a distance from the primary focus of infection does not justify the diagnosis of general peritonitis.

5. A drain does not extraperitonealize a zone already the site of spreading infection.

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CERTAIN TANGIBLE FACTORS IN THE ETIOLOGY OF URINARY CALCULUS¹

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THE factors producing urinary calculus are as yet not fully understood. Different types of concretions are the result of various etiological elements which may operate in many different combinations. The problem of etiology can not be solved by any simple formula. The following factors have been noted:

As to geographical distribution stone is more common in India, China and Egypt.

The races more commonly affected are the Hindus, Arabs, Chinese and Anglo Saxons.

Heredity is of little importance except in cystin stones.

Regarding the effect of diet on stone it has been found that stone is much more common in those living on a monotonous diet than in those who have a good varied diet. Joly states that in no case can the formation of stone be attributed to excess of stone forming substances in the diet.

At present some experimental data shows that stone may be associated with vitamin A deficiency.

Chronic diseases are the cause of urinary stone in some instances. Prolonged immobilization for fracture and wounds especially suppurating ones in which the urinary tract becomes infected—particularly when the bacillus coli and staphylococci are the infecting organisms—may be etiological factors.

In spinal injuries and disease urinary infection plays an important role. Mueller found bilateral urinary calculus in 8 of 10 cases of fracture of the spine which came to autopsy. Various types of spinal diseases associated with stone are spondylitis, arthritis deformans and spondylitis deformans. The largest bladder stone I have removed was in a patient with a severe spondylitis deformans.

Congenital anomalies of the urinary tract such as double kidney, bifid pelvis, horseshoe kidney, hypoplastic kidney, solitary kidney, cystic kidney and anomalies of blood vessels of the kidney are etiological factors. It is

noteworthy that all of these anomalies predispose to urinary stasis.

Males are affected two or three times as often as females.

The third and fourth decades are the most frequent ages for the appearance of stone.

Urinary calculi may be divided into primary and secondary types. In the primary type the calculus is formed in the apparently healthy urinary tract and is composed entirely of substances found in the urine from which it originates. The calculus may be composed of (a) uric acid, (b) xanthin, (c) calcium oxalate and (d) cystin.

In the secondary type the calculus forms as a result of some pathological change in the urinary organs inflammatory or otherwise and develops on a preformed nucleus.

My deductions regarding secondary calculus are based on a study of 33 cases. In all of these cases the stones were septic or infected and were obtained at operation or by manipulation through the natural passages.

Undoubtedly the two most important factors in the production of stone are urinary stasis and the consequent urinary infection.

It is conceded by most genito urinary surgeons that a urinary tract will not harbor infection for a long period provided there is no stasis and provided there is no interference with the unimpeded flow of urine from the tubules to the outer world. Conversely if stasis continues to be present it is practically impossible to rid the urinary tract of infection.

Two important factors in the production of stasis are (1) toxic damage to the pelvic and ureteral musculature as a result of which the expulsive ability is markedly decreased and (2) the presence of a peripelitis and perireteritis which produces mechanical changes in the excretory passages thereby predisposing to stagnation.

D Economos of Athens states: There is no bacillus coli infection of the urinary tract without urinary stasis but often this stasis is

slight or is difficult to discover thus it appears very often without being perceived. This fact has been substantiated by several workers who have studied the pyelitis of pregnancy. These workers have shown graphically interference with free drainage from the pelves of the kidney.

Stasis resulting from pathological changes in any portion of the urinary tract has a profound influence on stone formation because the free drainage of urine is interfered with and infection is promoted. In observing several pyelograms showing stone in the calyx a definite narrowing of the neck of the calyx was discernible and at operation the site and character of the stenosis was easily verified.

The comparative frequency of narrowing at the juxtavesical portion of the ureter as a result of adnexal disease in the male is well known. Hellstrom and Grossman have called attention to this condition as probably the most important factor in explanation of the appearance of stone more frequently in the male and of its greatest frequency in the third and fourth decades at which time gonorrhoea is a common disease. To both of these conceptions I subscribe. The association of bladder stone with hypertrophy of the prostate is not uncommon. Young states. Without an intravesical obstruction there will be no bladder stone of renal origin. However a very slight obstruction giving no urinary symptoms may be sufficient to cause the retention of a small stone.

In cases of non infected stones mechanical stasis is seldom demonstrable.

The persistence of infection suggests that stasis is present at some point in the urinary tract as a result either of some mechanical obstruction or of some other factor influencing the dynamics of some organ in the tract. There may be a nerve lesion of some type or other.

Infections of the urinary tract are for the most part hematogenous and the primary infection may be in an organ near at hand or in a remote part of the body. An analysis of the histories of 700 cases revealed postinfluenzal pyelitis as a common factor. male adnexal inflammations and infections of the teeth tonsils and sinuses were relatively frequent.

How can infection of the urinary tract be one of the two most important factors in stone formation? Theoretically the following reasons may be suggested.

1 Infection of the urinary tract causes a direct toxic action on the secretory apparatus especially on the specific secretion of acid.

2 Infection produces changes in the formation and excretion of colloids which are said to be necessary for retaining in solution the crystalloids present moreover the presence of the products of inflammation in the urine disturbs the colloid crystalloid balance.

3 The infecting organisms and resulting products of inflammation often serve as nuclei for the formation of secretions.

Experiments are now being made at the Michael Reese Hospital with the hope of clearing up some of the disputed points. The results are briefly stated.

All the 55 stones examined bacteriologically were infected. The technique used was that of Hellstrom. Half of the larger stones and the whole of the smaller stones were placed in a glass beaker containing dilute hydrochloric acid and permitted to dissolve until only a small nucleus remained. This nucleus was then smeared on glass slides and stained by the Gram method. The halves of the larger stones which were of sufficient size to be split in half under strict aseptic conditions were repeatedly passed through boiling water then broken up and inoculated into various culture media. When the cultures were examined it was found that our results closely paralleled those obtained by Hellstrom.

Examination of the 55 stones yielded the following organisms:

| | ct |
|------------------------------------|----|
| Staphylococci alone | 29 |
| Bacillus coli alone | 8 |
| Streptococci alone | 4 |
| Streptococci and staphylococci | 3 |
| Bacillus coli and staphylococci | |
| Bacillus coli and streptococci | 2 |
| Bacillus proteus | 1 |
| Bacillus proteus and staphylococci | 1 |

These stones can not be regarded as the result of a primary phosphaturia with secondary infection because the bacteria were actually found in the nuclei of the stones.

Similar work has recently been reported by Grossman at von Lichtenberg's clinic and by

others Grossman found nearly twice as many stones containing *bacillus coli* alone as staphylococci while in our series staphylococci appeared three times as often as did *bacillus coli*.

After the first ten or twelve stones were examined one could quite accurately foretell the type of organism most likely to be found in the nucleus. The large irregular stones uniformly contained *bacillus coli* alone or it was the predominating organism while in the small dark brown or black stones which were eventually passed via the natural passages cocci of some form were always found in the nuclei especially the staphylococci. The stones of intermediate size obtained by pyelotomy or rarely by nephrotomy likewise showed staphylococci in the majority of instances.

Rovsing expressed the opinion that a urea splitting organism especially the staphylococcus was the most frequent cause of recurrent urinary calculi. Encouraged by the recent work of Larilham and Pillet I undertook a study of a series of strains of staphylococci. Thus far 23 strains obtained from various sources have been examined by a rather simple but accurate laboratory technique to determine their ability to split urea. Of these 7 are definite urea splitters producing a definite increase in hydrogen ion concentration in the medium used a 1 per cent solution of urea in peptone water. In the splitting of urea ammonium carbonate is formed which produces ammoniacal urine. We have also determined the hydrogen ion concentration of the urine secured by means of the ureteral catheter in cases of stone and with the exception of urate stones the hydrogen ion concentration of the affected side has been uniformly higher than that of the healthy side.

Experiments have shown that staphylococci as well as a few strains of the *bacillus coli* will produce the precipitation of crystals when inoculated into sterile urines while in the controls which of course remain sterile no precipitate occurs. The hydrogen ion concentration of the inoculated tubes also is greatly increased while that of the controls is slightly if at all affected. This is of significance clinically because in several cases of upper urinary tract infection either in the presence of stone or its absence we have determined

that the hydrogen ion values return to normal when the urine becomes sterile after appropriate treatment.

Pillet experimented with numerous organisms of various groups and found that the staphylococcus and *bacillus proteus* could produce precipitation of crystals when inoculated into sterile urines and incubated at 37 degrees C for 24 hours and then left at ordinary temperatures for several days while *bacillus coli* produced such precipitation only very slowly. His experiments were well controlled and no precipitation of salts took place in the control tubes.

Cyranka states that some strains of *bacillus coli* have the ability to split urea but presupposes changes in the protective colloids of the urine.

Hellstrom made an ingenious series of experiments and subjected some of the urines to be inoculated to agitation with animal charcoal in order to enmesh the greater amount of colloids present. After inoculating the treated urines and the untreated urines with a known urea splitter he found that they behaved similarly in fact the alkalinity of the untreated urine was slightly greater than that portion which had been deprived of its colloids. The hydrogen ion concentration of both was markedly increased and there appeared a precipitate of urinary salts calcium phosphates and ammonium urates in both. The hydrogen ion concentration of the controls was very slightly increased and there was no precipitate of salts.

This would tend to show that the so called protective colloids did not exert their anticipated effect because the filtrate titrated against one tenth normal hydrochloric acid required slightly less hydrochloric acid to neutralize than did the whole urine. This point of view has also been expressed by Colonel Newcomb in the *Indian Journal of Medical Research*. He subjected urine to dialysis through a dialyzing sac and found that the precipitation occurred more often in the liquid within the sac containing the colloids than it did outside in that portion in which the colloids were absent. This shows that the urinary salts are not firmly attached to the colloids. When precipitation did occur in

the outside liquid not containing colloids the solution completely cleared by restoring the hydrogen ion concentration to its original value. The behavior of both the inside and outside solutions as regards precipitation seemed in each instance to run exactly parallel and be dependent only on the hydrogen ion concentration and to have nothing to do with the presence or absence of the urinary colloids.

He calls attention to the fact that uric acid is well known to dissolve more readily in the presence of many substances among others phosphates which are always present in the urine. Furthermore uric acid in the urine does not exist entirely as uric acid. The same applies to calcium oxalate or rather to the oxalate ion.

By the experimental use of other colloids such as starch, gelatin, serum, albumin, milk, he showed that these likewise had no effect upon the solubility of uric acid, oxalates and phosphates in an artificial mixture of salts resembling urine.

The same point of view is expressed by J. Meyer¹ in a lengthy paper on precipitation of salts from the urine with special reference to stone formation in which he concludes that in every respect precipitation of crystalloids from the urine follows precipitation from any complex solution and that the urinary colloids which are undoubtedly present have nothing to do with precipitation of salts from the urine or maintaining them in solution.

Numerous writers including Osborne and Mendel, Fujimaki, McCarrison, Van Leersum and others have reported the artificial production of stones in animals when kept for a long time on a diet low in vitamin A. These experiments may possibly be interpreted as an analogy to explain the cases occurring in infants at the breast in Dalmatia where vesical calculi in nurslings is common and when the mothers often are in a state of marked malnutrition. Similar circumstances may be important in India, Egypt and China where famine often appears. However it would seem that the effect of a diet very low in vitamin A acts in an indirect manner rather than as a specific etiological factor. As a result of dieting experimental animals—rats have been

used chiefly—a profound state of malnutrition occurs in fact many experimental animals die before stone formation takes place. Therefore as a result of the severe nutritional disorder they are more susceptible to infections of all kinds. Experimentally it has been shown that infection of the urinary tract occurs in an overwhelming percentage of cases. Of course other localizations of infection co-exist. The stones produced are phosphatic and only 14 per cent in one series were aseptic while in another and larger series 97 per cent were infected. Therefore it seems that the chief effect of vitamin A deficiency is to increase the susceptibility to infection and that infection of the urinary tract occurs in almost every animal so dieted. Incidentally the experimental diet is highly alkaline.

I have omitted a discussion of the chemistry of infected urinary calculi because it seems to afford no important data from an etiological point of view. So few stones are made up of one component alone that I did not think important deductions could be made from their chemical analysis.

SUMMARY AND CONCLUSIONS

An attempt has been made to discuss certain etiological factors in the formation of urinary calculi.

1. Urinary stasis is of greatest importance from whatever cause or wherever located.

2. Infection of the urinary tract is subsequent to and dependent upon urinary stasis.

3. If the infecting organism is a urea splitter the likelihood of stone formation is markedly increased.

4. Certain bacteria especially those belonging to the staphylococcus albus group are potent urea splitters and produce alkaline urine.

5. The nuclei of the entire series of 55 stones examined contained bacteria which appear to be material factors in their production.

6. The hydrogen ion concentration of the urine is an important determination. It seems to be the material factor in the precipitation of urinary salts. The hydrogen ion concentration of the urine obtained from the diseased side is usually higher than that from the healthy side in cases of lithiasis.

7 When the urine becomes sterile again after appropriate treatment for stone or infection or both the hydrogen ion concentration tends to return to normal

8 In the light of recent experimental work it appears that the so called protective urinary colloids may not play the important role ascribed to them

9 Vitamin A deficiency seems to be an indirect contributing factor in experimental calculus formation producing an increased susceptibility to infection in general and especially in the urinary tract

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SURGICAL SIGNIFICANCE OF DERANGEMENT OF INTESTINAL ROTATION AND DISTRIBUTION

THOMAS MEARES GREEN M D F A C S WILMINGTON D E W R C ROLIN

DURING fetal development many derangements of distribution of the abdominal portion of the alimentary tract may occur. Those derangements that call most frequently for immediate relief manifest themselves with volvulus during early infancy and are due largely to improper disposition of the abdominal portion of the alimentary tract. The first portion or foregut from which the stomach and duodenum as far as the biliary papilla is formed is practically never at error in location or attachment. This is quite true of the third portion or hindgut from which is elaborated the left transverse colon sigmoid and rectum. In the midgut portion however from which arises the terminal duodenum jejunum ileum cecum ascending and right half of the transverse colon practically all of the errors of disposition or attachment occur. In order that we may better understand the pathology of these errors of distribution and attachment let us briefly review the normal development of the abdominal portion of the alimentary tract its formation its distribution as well as

its fixation within the abdomen. At about the fifth week of (Fig 1) fetal life the abdominal alimentary tract is composed of three distinct loops or subdivisions which may be designated as the foregut midgut and hindgut all of which are attached by their special mesenteries to the aorta in the mid body line. In each mesentery runs the special blood vessel for its supply that is the coeliac axis to the foregut the superior mesenteric artery to the midgut and the inferior mesenteric artery to the hindgut. Already at this stage the bulge of the stomach may be seen on the foregut and the caecal bud or beginning of the formation of the caecum on the midgut. As the stomach grows it develops more rapidly on its greater curvature than on the lesser curvature causing it to assume the oblique and finally transverse position (Fig 2). It carries the first portion of the duodenum with it giving to that portion of the duodenum its horseshoe like curve which is further accentuated by the development of the pancreatic bud within its curve. The thickened shortened mesentery of the duodenum further serves to fix this por-

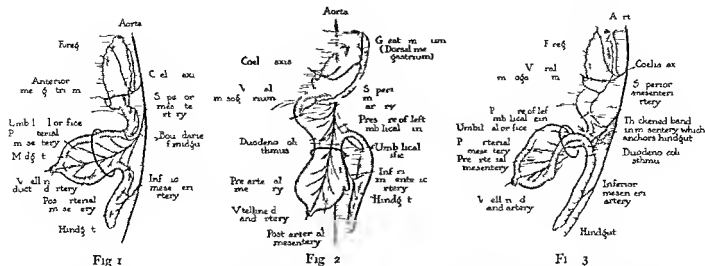


Fig 1 The primitive alimentary tract at the fifth week consist of foregut midgut and hindgut attached to the aorta in the mid body line by their special mesenteries in which is seen the special arterial blood supply: caecal axis to foregut superior mesenteric artery to midgut and inferior mesenteric artery to the hindgut.

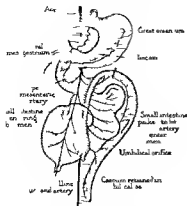
Fig 2 Stomach becomes more transverse in position carrying duodenum with it in a curve. Here the hindgut is definitely to the left side and midgut to the right. Non

tion The development of the stomach and most of the duodenum is controlled by intrinsic forces and not dependent upon other factors hence this constancy of position. From the upper end of the mesentery of the hindgut which occupies a midline position there develops a thickening or band like formation within its mesentery which attaches the upper portion of the hindgut to the vicinity of the origin of the superior mesenteric artery. This band as described by Frazier and Robbins does not grow as rapidly as the gut or its mesentery so therefore is much shorter and acts as an anchorage. The hindgut being hitched up at this point by this band gradually becomes flexed which flexure is known as the colic angle. The position of the hindgut then becomes fixed at an early date and like the foregut is constant in its position. The midgut can be seen now as a loop situated within the abdomen and protruding partly out through the umbilical opening into the cord. The herniation of the midgut becomes necessary due as Frazier has suggested to the rapid development and abnormal size of the fetal liver as well as to the rapid growth of the gut itself which literally pushes the midgut into the cord. Traversing the mesentery of the midgut is the superior mesenteric artery

rotation is a persistence of this relation. Arrow indicates point of pressure of left umbilical vein.

Fig 3 Eighth week. Here the left umbilical vein has pressed the prearterial segment of the midgut loop downward and to the right forcing the postarterial segment upward and to the left thus causing the midgut to assume an S shape. The first stage of rotation has been accomplished.

which enters the mesentery at the constricted area between the duodenum and the colic angle. This narrow mesentery is known as the fetal mesentery. The mesentery of the midgut is divided in two portions by the superior mesenteric artery one portion known as the prearterial portion the other the postarterial portion. As we have just seen these two leaves of the midgut mesentery are attached posteriorly in the narrow space known as the duodenocolic angle. The development of the midgut is now very rapid and that portion of it supplied by the anterior or prearterial leaflet develops more rapidly in length than the portion attached to the postarterial leaflet. Indeed the postarterial leaflet gradually becomes shorter and thicker. The right umbilical vein has now become obliterated but the left persists pressing down on the prearterial portion of the midgut loop (Fig 3) due to the enlarged liver forcing it down and to the right the postarterial leaflet being pushed up and to the left causing the midgut to assume an S shape appearance. This constitutes the first stage of rotation. Anomalies of this stage occur only in the presence of total extorsion. There is also an increased growth in the caecal bud and the colon above it. This first stage of rotation occurs



F 4 T h w l H t h p e t l m t
(m l l t t) f t l m d g u t h a s a l d y b g u n t t
t h b d m n t t t l c k w e b t h t s p
m t t r y T h p e s e n t f t h p g s s f t h e
d t g o f t t i n

between the fifth and tenth weeks. At the beginning of the tenth week we see the *second stage* of rotation begin. According to Frazier and Robbins there occurs at this time a definite shrinkage of the size of the liver so that space within the abdominal cavity is now available. Indeed a suction force or vacuum is created so that the midgut gradually begins to return to the abdomen. This is facilitated by the fact that the cæcum is so large that it remains in the cord with the most distal loop of the midgut and enters the abdomen last (Fig 4). The superior mesenteric artery passes obliquely downward from its origin at the aorta out through the umbilical opening so that it stretches like a rope across the abdomen. It is manifest that all of the gut cannot return at

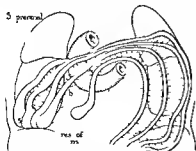
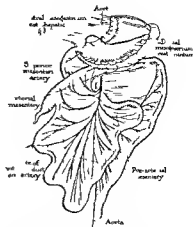


Fig 6 The cæcum has not yet descended to the right iliac fossa. The midgut with the small intestine is still in the abdominal cavity. The large intestine is still in the abdominal cavity. The liver is still in the abdominal cavity. The stomach is still in the abdominal cavity. The spleen is still in the abdominal cavity. The pancreas is still in the abdominal cavity. The gallbladder is still in the abdominal cavity. The duodenum is still in the abdominal cavity. The jejunum is still in the abdominal cavity. The ileum is still in the abdominal cavity. The cecum is still in the abdominal cavity. The sigmoid colon is still in the abdominal cavity. The rectum is still in the abdominal cavity. The anus is still in the abdominal cavity.



F 5 E l e t h w l A l l f t h p r t r a l m t
h t f d t h a b d m e t t d h t h t h p r
m t e a t r y A s t h s c d c l e t d t h b
d m t h h l g u t w s c w d d f o m t h n d l i
to the left and p w d d d o w n w r d t h c o i l f t h p
a t e l l f t g t h m l e f o m l e f t h y p o h
d m t o h t i l f T h c æ m e t e d i t T h e
d t g f t a t h b m p l e t d

once through the comparatively small umbilical opening. In order for the gut to return to the abdomen it must do so in an orderly manner if the proper distribution of its parts is to occur within the abdominal cavity. This normal reduction begins with the passage of that portion of the small gut nearest the duodenum downward and beneath the mesenteric artery in an anti clockwise manner from right to left. Other loops follow until all have entered except the cæcum with the terminal portion of the mesenteric artery. As the midgut passes into the abdomen the coils passing from right to left behind the superior mesenteric artery crowd over to the only available space within the abdomen that is to the left and upper areas pushing the hindgut from its midline position over to the left and downward and backward. The last coil to leave the umbilicus carries the distal portion of the mesentery artery with it (Fig 5). The cæcum follows but lies on an anterior plane to the small gut on a level with the umbilicus and anterior to the mesenteric artery. As the colon grows it lengthens and straightens out carrying the cæcum upward and toward the under surface of the right lobe of the liver (Fig 6). Later as it elongates it passes downward to the right iliac fossa carrying with it the mesentery and superior mesen-

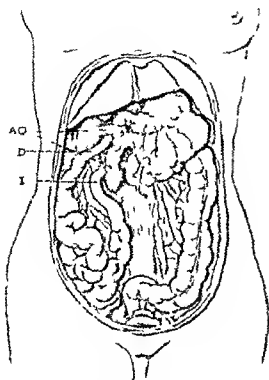


Fig. 7 A type of non rotation in which the cecum was fixed behind the artery and the ileum crossed the upper abdomen to enter it

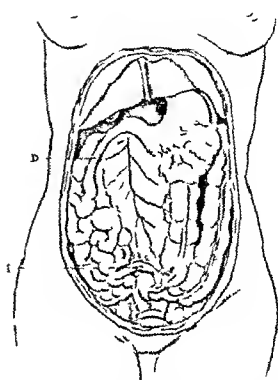


Fig. 8 Another type of non rotation in which the colon assumed a horseshoe shape and the ileum crossed the pelvis to enter it

teric artery. This completes the second stage of rotation. From its free unfixed position we find that the cecum when it first enters the abdomen may pass in almost any direction which accounts for most of the errors of improper distribution and abnormal fixation. In this anti clockwise rotation about the superior mesenteric artery the duodenum has been made to cross behind the artery the cecum to cross in front of it—the hindgut being crowded downward and to the left—and the coils of the midgut to pass behind and arrange themselves from the left hypochondrium to the right iliac region. In the third stage of rotation the cecum further elongates and descends to the right iliac region the superior mesenteric artery deviating downward and to the right with it. The postarterial mesenteric leaflet becomes obliterated while the pre arterial leaflet fuses with the posterior parietal peritoneum to form the mesentery of the small gut acquiring an attachment from the second lumbar vertebra downward to the right iliac vessels. This fusion is so marked with the cecum and the ascending colon that its mesentery is

practically obliterated like that of the hindgut. However the mesentery to the transverse colon remains long.

Derangements of distribution include according to Dott (1) non rotation (2) malrotation and (3) reverse rotation.

Anomalies of distribution do not occur in the foregut or in the hindgut because of their constancy of development and further because their development is not so elaborated as that of the midgut. Further it is rarely found to occur during the first and third stage of rotation in the midgut. It is common in the second stage. The etiology of anomalous arrangement and fixation of the gut is somewhat obscure. Mr Norman Dott explains it as due to the sudden return of all of that portion of the midgut situated within the cord through an abnormally large umbilical opening. This would preclude the orderly and gradual return of the pre arterial loop of the midgut to the abdomen and hence prevent proper rotation and arrangement within the abdomen. Adhesions are not etiological factors since only a mobile intestine could reach

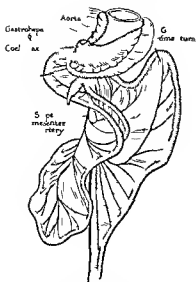
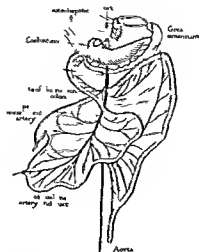
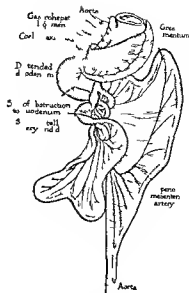


Fig 9



Fig



Fig

Fig 9 H e t h c a c m h p a s d t t h e p y l o r i c g n d b m p e m a t l y f i e d T h c a c u m d p t l e g m e n t n w h a e l g m t e r y t t a c h e d n l y t h d o d o c o l g l e v l u l m o t p t c c

Fig 10 A r e e r o t a t w i t h t h c a c u m f i d b h i n d

t h e s p r i m e t e c a t e r y I f t h a c m d e s t b c o m f e d e a l y o f l u s s p t t o u

Fig 11 I f a l l t h m l l g u t (p t l s e g m t o f t h m i d g u t)

these abnormal positions. Different pathological arrangements of the midgut depend upon which direction the cecum takes after its reduction to the abdomen (Figs 7 and 8). In non rotation it passes upward into the left quadrant so that the entire colon and cecum are arranged to the left of the midline with the

entire small bowel to the right of the midline the ileum crossing from right to left to enter the cecum. In mal rotation (Fig 9) the cecum passes up to the region of the pylorus and becomes attached there or further over into the subhepatic area which prevents its elongation and descent. This leaves an elongated narrow mesentery of the fetal type with no points of fixation of the ileum and jejunum except in the narrow duodenocolic angle. In reverse rotation (Fig 10) the loops of small gut instead of passing from right to left behind the superior mesenteric artery pass from left to right in a clockwise manner.

This brings the cecum to lie behind the superior mesenteric artery where it is fixed. This is a rare type of anomaly. Derangement of the third stage consists largely of an undescended cecum in the subhepatic area due to too early fixation or to a pelvic cecum due to no fixation. Under any of these circumstances volvulus and obstruction may occur especially in infants. The volvulus as a rule is not sufficiently tight at first to interfere with circulation but it practically produces obstruction of the lumen of the gut. Later however circulatory disturbance will occur.

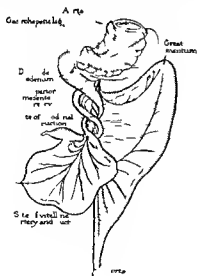


Fig 2 V l u l u s f t h m a l l g u t c a c m d s c d g d g h t h a l f f t e s e l o n (t m i d g u t)



Fig. 13 left Stomach full showing dilatation of stomach and duodenum down to biliary papilla.

Fig. 14 Same view as shown in Figure 13 after vomiting had occurred showing some dilatation of stomach and duodenum down to the biliary papilla. Obstruction is not complete as part of the opaque meal has passed into the jejunum.

and gangrene develop. Clinically the condition is not very difficult to diagnose in infants but is especially difficult in older children and adults. In infants there is the picture of obstruction incessant vomiting of everything the presence of peristaltic gastric waves. While this vomiting is projectile it does not occur so soon after taking of food as in hypertrophic pyloric stenosis and contains large quantities of bile. The presence of bile in the vomitus should at once suggest that the condition is not pyloric stenosis. Early in the condition the obstruction is not always so complete and it is possible to find some milk curd and bile in the washing of the colon. The X ray of the stomach will show the dilated stomach and duodenum down to the biliary papilla and the X ray of the colon will at once establish its position. When the volvulus occurs it will usually include all of the small gut (Fig. 11) or all of the small gut with the caecum and ascending colon (Fig. 12). Mr George Waugh of London recently published an interesting paper in which he reports 4 cases of 5 diagnosed in older children. In addition to the peculiarity and irregularity of the abdominal pain i.e. not associated with taking food or bowel movement he lays great stress on the emptiness of the right side of the abdomen.

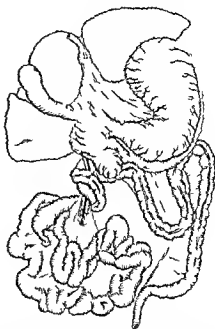


Fig. 15 Volvulus of the entire midgut with 1 turn in a clockwise direction. Caecum and ascending colon are not fixed as no fusion of their mesentery with parietal peritoneum has occurred.

It seems to occur more frequently in the male and during the first few days of life. When demonstrated in adults these anomalous arrangements of the intestines are usually discovered during an operation for appendicitis the appendix found displaced as it was in one of my cases. In reviewing 45 cases

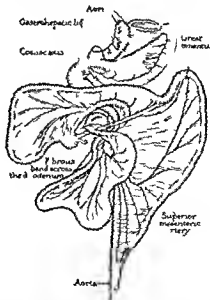
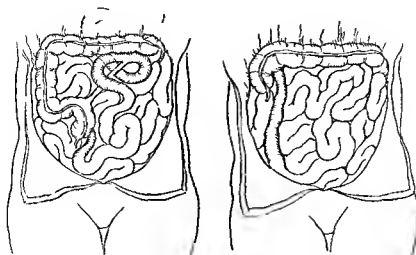


Fig. 16 Band across the duodenum to caecum preventing complete descent and fixation of caecum and small gut. This band produces obstruction of the duodenum and predisposes to volvulus by creating faulty attachment of the caecum and small gut.



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 lm t g ed th n ht l cf sa t mes tery ha p th f s l w th th p st
 p t l p nto m h t w sp tal E ly d b rm l f f th m se
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 d a d dh de el p d f m th r m th d od m at h
 l l t t hm t f th m t ry f th ma g p to f th m ll
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 F 8 F ly f t f th x mp t g t desc t t th ht la
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Norman Dott found 35 discovered accidentally in adults who gave no symptoms. Weible reports a series of 67 cases of volvulus many in adults. It may exist far more frequently than one would suppose. The treatment in infants is imperative and must be instituted at once. It is most important to know not only that the volvulus exists but it is well to know as far as possible in a general way what the anomalous distribution is. The incision must be located at the point in the abdomen which gives most ready access to the seat of pathology. Fortunately the upper right rectus approach usually answers this question. The treatment consists of reduction of the volvulus which we have seen includes usually all of the small gut. The mesentery of this mass of gut is untwisted after which fixation at several points of the ascending colon and cecum to the parietal peritoneum is usually all sufficient.

There is an extremely high mortality rate particularly in infants. I feel however that this high mortality rate especially in infants is due to the fact that most of the patients were moribund when presented for surgery.

The following case reports are submitted as a contribution to the literature on this subject.

CASE 1. B by R aged 6 days female child referred by Dr. Bender of New Bern to Dr. J. B. Sibley at the Babes Hospital with whom it was my privilege to see the case. There was a history of normal birth the being the third normal child of these parents. Vomiting began immediately after birth upon taking food was incessant and projectile in character and consisted of fluids alone with a large quantity of bile. Colon catheters showed a few milk curds (Figs. 13 and 14). A ray picture of the barium filled stomach showed a marked dilatation of the stomach and duodenum. The child had been sustained with glucose intravenously. An operation was advised and diagnosis of duodenal atresia having been made. The child was given a general anesthetic and the right rectus was opened in the middle third. Upon entering the abdomen a few hillocks of ether were given to complete the anesthesia. A marked torsion of the entire midgut in a clockwise direction as demonstrated (Fig. 5). Circulation in the mesentery was not interfered with. The torsion consisted of one and a half complete turns. After untwisting the volvulus the gut could be easily distended with blood into the stomach through the stomach tube and made to pass into the gut by pressure on the stomach. The mesenteric blood supply was of fetal type and attached only to

the duodenocolic angle. This mesentery was common to the small gut, cecum and ascending colon. No fixation of the cecum and ascending colon had occurred. The cecum and ascending colon were fixed at several points to the parietal peritoneum with sutures. The child made an uninterrupted recovery and is now a well developed child of 6 months.

CASE. Baby S, a female child 4 days old, was referred to the Babies Hospital by Dr. J. W. Carroll of Wallace. It was my privilege to see this child with him and Dr. Sidbury. The child had been vomiting everything since birth which was normal. Vomiting was persistent, projectile and consisted of fluids taken plus a great deal of bile. Peristaltic gastric waves were present but vomiting did not occur as quickly after taking fluids as it does in pyloric stenosis. Washing of the colon showed a few milk flakes but no bile. Operation was determined upon immediately, diagnosis, volvulus of the midgut. The child was given $\frac{1}{4}$ grain morphine and the right rectus was opened under a local anesthetic. No other anesthetic was necessary. There was a volvulus of $1\frac{3}{4}$ complete turns of the small gut in a clockwise direction (Fig. 16). The duodenum did not pass across the spine but ran downward to the right side of it and emerged from its rectoperitoneal position there. At this point a band was found which passed across the duodenum from above and was attached to the mesentery of the cecum below, having pulled the cecum sharply upward and to the left out of the right iliac fossa (Fig. 17). After the duodenum merged into the jejunum the first loop of jejunum passed upward and to the left, then across the spine and downward to the right. The mesentery of this loop was fused with the mesentery of the transverse colon so that the jejunum really merged into the abdomen through the mesentery of this loop. I do not feel however that this condition had any bearing upon the pathology at hand. After the band across the duodenum was divided the cecum was returned to the right iliac fossa and was fixed there by several sutures. The mesentery of the ascending colon had been practically fused with the parietal peritoneum. This child made an excellent

recovery but died at 6 months of age of pneumonia. No autopsy.

CASE 3. A colored adult female gave a history of mild repeated attacks of pain along the right costal border. In spite of this I felt that the present acute attack was a postpericardial appendix of high location. At operation the cecum and ascending colon were found to lie in the subhepatic area (Fig. 18). Here was found a typical undescending cecum fixed in the subhepatic area with the ileum approaching it from below at the right angle. A large diseased appendix was removed. This girl made an uninterrupted recovery.

I do not think that this malposition of the cecum interfered with her health. This is quite true in most pronounced types of malrotation and non rotation after adult life has been attained.

DEDUCTIONS

1. It is quite possible that derangements of distribution exist more frequently than is supposed.
2. It seems reasonable to assume that the condition can be recognized more readily from a clinical standpoint.
3. Early recognition will most certainly lead to improved results.

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INTERMITTENT GASTRIC ILEUS DUE TO MECHANICAL CAUSES¹

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AND

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THE term gastric ileus denominates a clinical syndrome characterized by pain in the upper abdomen vomiting of gastric contents more or less distention of the stomach and obstruction at the pylorus as determined radiologically. As with ileus of the intestinal tract the gastric form may be either dynamic or mechanical. Of the two types the mechanical variety is of more particular interest to the surgeon. Gastric ileus on a mechanical basis may be continuous or intermittent. The continuous type represented by the familiar pyloric stenosis is well apprehended and its causes are a matter of common knowledge. The intermittent variety is in general poorly understood and its various causes unknown to many. Even an intensive search through the literature does not shed much light for merely unassociated and scattered bits of information pertaining to the subject are encountered. Failing to find any collected data in either texts or periodicals we were led to study our own records from which we were able to gather examples of intermittent gastric ileus due to four different mechanical causes. These include benign tumors a malignant polypoid tumor a gastrolith associated with a pre-existent pyloric stenosis and an anomalous redundant fold of prepyloric mucous membrane.

BENIGN TUMORS OF THE STOMACH

The most exemplary instance of intermittent gastric ileus on a mechanical basis is the benign pedunculated tumor of the stomach. This type of neoplasm is capable of producing obstruction according to one of two mechanisms. The new growth may act as an obturator to the pylorus functioning as a ball valve or it may incite such vigorous peristalsis as to produce intussusception of the stomach into the duodenum. It is quite likely that in

the same case obturation and invagination may occur simultaneously or alternately. The first of these two primary mechanisms namely entanglement of the tumor in the pyloric opening which is the more common variety was introduced to the profession by French observers. The first report was that of Breschet who in 1816 described a case of pyloric obstruction due to a polypus which arose from the lesser curvature 3 inches distal to the cardia and passed into the duodenum. Cruveilhier called attention to the mechanical effects of gastric polyps and mentioned a case of intermittent obstruction which became permanent and caused death. Cornil in 1863 described a case in which at autopsy a pedunculated tumor could be returned freely from the pyloric orifice which it had occluded to the stomach where it had its point of origin.

An opportunity was afforded Bernabei to observe during life a woman who for a long time had suffered from intermittent attacks of vomiting and epigastric pain. At autopsy a long polypus implanted 5 centimeters from the pylorus together with five other small polypi in the antrum and along the greater curvature were found. An illustrative and instructive case was reported by Cleghorn of a man 57 years of age who experienced attacks of epigastric pain attended by nausea and vomiting. These symptoms occurred at irregular intervals some hours after a meal and lasted from a few minutes to 2 to 3 hours. The attacks terminated abruptly followed by rumbling and gurgling over the site of pain. A postmortem examination disclosed a gastric polypus 3 inches in length capable of becoming engaged in the pylorus and a prepyloric perforation. A pedunculated polyp measuring 11 centimeters in length and 2 centimeters in breadth which arose 3 centimeters proximal to the pylorus was pictured

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Fig 1 Case 1 Stomach and duodenum opened along the lesser curvature. An infiltrating tumor has led to an annular thickening of the distal third of the stomach wall. A pedunculated cauliflower mass B arises from the greater curvature just proximal to the pylorus C. The first portion of the duodenum D is greatly dilated.



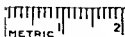
Fig 2 Case 2 The X-ray deformity resulting from a prepyloric ulcer and a coexistent foreign body (Fig 3).

by Calzavara in 1893, proposed in the duodenum. In Steiner's collected cases of myoma of the gastrointestinal canal, those of Herhold and Pernice are particularly noteworthy with respect to pyloric obstruction. An interesting case of intermittent gastric ileus due to a pedunculated benign polyp of the stomach was reported by Lucksch, who emphasized the close clinical resemblance to carcinoma. An illustration in Tuffier's book of a specimen from the Dupuytren museum depicting a gastric tumor engaged in the pylorus demonstrates at a glance the mechanism involved.

The attention of surgeons in this country was attracted to the subject in 1907 when Gibson presented before the New York Surgical Society a polyp which had been surgically removed from a man aged 64 years. The tumor sprang from just inside the pylorus and had a ball valve action. This tumor, Gibson states, had apparently intermittently plugged the pylorus giving rise to pyloric obstruction. In the discussion which followed, Blake spoke of a case in which he had operated 4 years prior. The tumor proved to be an adenoma which was pedunculated and at times caused symptoms of obstruction by being swept into the pyloric

orifice. Since the appearance of Gibson's paper, many other cases of benign tumor of the stomach causing intermittent obstruction of the pylorus have been published. These reports no longer merit detailed individual consideration for the occurrence of the disorder can no longer be regarded as unique. Our own experience includes 3 cases, 2 of which were previously reported (Meyer and Brans, Singer). The third patient was an old man who gave a history of intermittent attacks of gastric ileus but at the time of entrance was suffering also from an ascending urinary tract infection secondary to prostatic hypertrophy. He died from the urosepsis a few days following admission. At the post mortem examination a gastric polyp was found prolapsed into the duodenum.

A second and less frequent mechanism by which a gastric tumor leads to pyloric obstruction, namely through the incitement of peristaltic hyperactivity and consequent intussusception, has likewise been known for many years. Chari in 1888 recorded a case of a woman 44 years of age who died with symptoms of pyloric obstruction. At post



F 3 Ca G t l th h h I m d i a i m h
th t f a p l t s (T g) f l l w th a l
m t t n f S p p y p d e

At mortem examination there was found an intussusception of the stomach into the duodenum which could be readily reduced. At the apex of the intussusception was a cauliflower like growth. An attack which occurred 8 weeks prior and from which recovery followed without medical aid was explained by Chiari on the basis of spontaneous reduction. In the case reported by Collier of a young man of 21 the stomach at operation was found intussuscepted into the duodenum. At the postmortem examination multiple polyps scattered throughout the stomach and small intestine were found. A dissecting room subject a woman of 75 years was observed by Thompson to have a polypus which grew from the margin of the pylorus and had dragged the latter and the first part of the duodenum into the second portion of the duodenum. The case of Lotsch was unusual in the respect that the invaginated tumor by exerting pressure on the papilla of Vater led to biliary obstruction.

The first case of gastroduodenal intussusception successfully treated surgically was reported by Wade. The cause of the intussusception proved to be a pedunculated myoma of the stomach which had led to intermittent attacks of gastric ileus. The third case in the series of benign tumors of the stomach recorded by Eusterman and Senty dealt with a woman of 65 years who had had symptoms intermittently for 6 years. Operation disclosed a fibromyoma which drew the posterior wall of the stomach into the duodenum for a total distance of 12.5 centimeters. The case reported by Baylac and Dieulaife is particularly noteworthy as it demonstrates that an intramural non pedun-



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t e s p e c t l y h h m m m b e d b y m

culated growth may also produce invagination of the stomach. The tumor a fibromyoma weighing 45 grams located within the gastric wall excited such relentless propulsive efforts as to lead to intussusception of the stomach into the prepyloric vestibule. A classical instance splendidly presented of a ball valve tumor which finally led to intussusception is reported by Matas. The patient a man of 55 years suffered from paroxysmal attacks of acute violent epigastric pain accompanied by shock and a sense of persistent depression, faintness, pallor with nausea and vomiting of gastric contents (no blood) followed soon after by the passage of dark tarry stools. Following removal of the tumor the pain ceased and the patient was restored to health. A remarkable case was that published by Barnett of a large myoma which arose from the cardia and which could be moved by virtue of invagination of the fundus through the widened duodenum for a distance of 20 centimeters into the jejunum. The illustrations in the article clearly depict the mechanism involved and the conditions that were found

POLYPOID CARCINOMA OF THE STOMACH

The most important sequel of mucous or adenomatous polyps is as Cruveilhier indicated carcinomatous degeneration. A case in point was described by Lemaître and the relationship of the benign to the malignant polyp is abundantly confirmed by Ebstein and Menetrier. It is no surprise, therefore, to learn that pedunculated tumors of the ball valve type are not infrequently malignant. The difficulty in distinguishing between adenomata and polypoid carcinomata has been emphasized repeatedly. The opinion of the expert radiologist may furnish no aid (Konjetzny Holmes). Even the fortunate circumstance of the presence of a benign polyp in the vomitus or aspirated material may not lead to a correct conclusion since benign and malignant polyps may coexist. In the case recorded by Chiari of gastric intussusception due to a benign polyp there was found in addition to multiple benign tumors a plaque like thickening of the mucosa which represented an early adenocarcinoma. We have had the opportunity of observing a similar case of early carcinoma in a stomach the seat of a polyposis with symptoms suggestive of intermittent pyloric obstruction. Since in practically all cases of intermittent pyloric obstruction occasioned by tumor growth surgical intervention is the treatment of choice preoperative identification of the type of neoplasm from the practical viewpoint is not essential. The following case furnishes an example of intermittent gastric ileus due to a polypoid carcinoma and illustrates the difficulty of differentiating before operation between benign and malignant ball valve tumors.

CASE I. F. E., a moderately obese male of 50 years was brought to the Cook County Hospital on May 27, 1929 with a note stating that the patient had been attending the cardiac clinic of a neighboring dispensary. On the day of entrance while sitting in the dispensary waiting room the patient was suddenly seized with a violent epigastric pain attended by vomiting. Morphine was administered and the patient was transported in a wheel chair to the hospital with a diagnosis of coronary occlusion. The history obtained after admission to the medical ward included symptoms referable to the cardiovascular, cerebral and gastrointestinal systems. The cardiac manifestations

which had been present for 1 year were comprised of shortness of breath, precordial pain on exertion and swelling of the ankles. A cerebral disorder was suggested by headache, dizziness, ringing in the ears and fainting all of recent origin. The gastrointestinal symptoms which were most obtrusive consisting of attacks of intense epigastric pain associated with nausea and vomiting were of only 2 weeks duration. Altogether 4 attacks of vomiting and pain had occurred, each one lasting from 2 to 3 hours. Between paroxysms the patient was aware of a mild discomfort. The appetite was impaired but no loss of flesh had occurred. The patient's maximum weight corresponded to the weight at entrance which was 190 pounds. There had been only slight diminution in the general strength.

Physically the patient was well developed and moderately obese. There was a distinct pallor of the skin and mucous membranes. The pulse rate was 60, the temperature 98.8 degrees F and the respiratory rate was 20. The blood pressure was 14-66. The only physical changes observed were arteriosclerosis of the retinal vessels, a soft systolic murmur in the region of the apex and tenderness in the epigastrium to the right of the midline. The erythrocyte count was 3,200,000, the hemoglobin determination 65 per cent and the white cell count 8,800. The Wassermann test was reported positive (+). The electrocardiogram indicated a left ventricular preponderance but no evidence of coronary disease. At the end of one hour the Ewald test meal yielded 50 cubic centimeters of poorly digested material having no free and a combined acidity of 16 degrees. The test for occult blood was positive. The diagnosis of cholelithiasis was favored and a Graham Cole test ordered. The dye was administered and the gall bladder was not visualized.

Except for occasional emesis the patient evinced no further signs of abdominal disease until June 7, 1929, 11 days after entrance when uncontrollable vomiting and severe epigastric pain reappeared. An X-ray examination was undertaken when the attack had apparently subsided but the patient either would not or could not retain an adequate quantity of barium. Nevertheless the roentgenologist Dr. C. H. Warfield could discern what he interpreted as a filling defect of the pars pylorica. On the following day, June 8, 1929, we were called to see the patient. A fullness and resistance in the epigastrium were present but no actual mass could be detected through the thick abdominal wall. Although the patient had ingested nothing for 16 hours prior to aspiration of the stomach yielded 1,000 cubic centimeters of material which had a free acidity of 10 degrees and a combined acidity of 40 degrees. Concomitant with the emptying of the stomach the patient felt relieved and the epigastric resistance vanished. Reflecting on the discrepancy in amounts obtained when the Ewald meal was recovered and when the fasting stomach was aspirated and considering the cyclic nature of the vomiting together with the X-ray evidence of intra

gastric disease a diagnosis of intermittent gastric ileus was made due to a tumor of the ball valve type. The anamnesis ascribed to it was of the undigested polyp.

During the examination a coarse tremor of the left hand was noted. A psychic disturbance was apparent. Surgical intervention appeared indicated but not urgent. Therefore a lumbar puncture was allowed before an opinion as to the type of aneurysm was rendered (LeCount and Singer). The spinal fluid contained 180 cells per cubic millimeter, an increased amount of globulin and yielded a positive Wassermann. The patient's mentality became more clouded but his physical condition remained unaltered. Blood chemical determinations failed to show any significant alterations. The patient was transferred to one of the surgical wards on June 14, 1929 with the recommendation that he be operated upon under local anesthesia. The following day the patient's vomiting returned. Expecting the emesis to subside as with similar previous attacks, active intervention at this time was deemed inadvisable by the resident internes. When it became apparent that the obstruction showed no inclination to recede spontaneously, the attending surgeon on the case called. He considered the patient too poor an operative risk and advised continuance of intravenous and subcutaneous fluids etc. Fecundities of biliary obstruction superadded and the patient succumbed June 19, 1929.

The autopsy was performed by Dr. P. H. Jaffe. The observations are summarized below. The immediate cause of death was carcinoma of the pylorus. The tumor (Fig. 1) had infiltrated the distal third of the stomach but had not led to stenosis of the pylorus. From the greater curvature side of the stomach sprang a cauliflower-like mass 11 cm. in length and 5 centimeters in its widest diameter. It was attached by a pedicle having a broad base. The pedicle 4 cm. in length and 4 centimeters in diameter comprised one-fifth of the length of the stomach, permitted free motion of the mass in all directions. When allowed to fall caudad the papillary mass protruded into and occluded the pyloric opening. The first portion of the duodenum was dilated to twice its normal size. Microscopically the tumor presented the histological characteristics of an adenocarcinoma. Besides the primary tumor there were metastases in the liver, the perigastric peripancreatic and periaortic lymph gland. In addition to the carcinoma and its metastatic deposits the patient had a syphilitic aortitis of the thoracic portion with mural thrombi in the ascending aorta, a luetic leptomeningitis and a recent hemorrhagic biliary obstruction in the right upper and lower pulmonary lobes. The other changes noted were of no material consequence.

FOREIGN BODIES

A large variety of foreign bodies of different size, form, consistency and origin have been

found in the stomach both at the operating and postmortem tables. The types of concretions and the symptoms they produce have been described by the Fenwicks and more particularly by Woelfler and Lieblein in their comprehensive monograph on foreign bodies in the human gastrointestinal canal. Although pain and vomiting are considered the two most obtrusive manifestations of the disorder, the picture of intermittent gastric ileus as such is not depicted by the authors mentioned above. In the case of gastrolithiasis observed by us to be rectified below, pain and vomiting were likewise the presenting complaints. It was however their intermittency without demonstrable cause which characterized and distinguished these symptoms sufficiently to lead to a suspicion of a ball valve obstruction. The mechanism involved is presumably similar to that described in connection with so-called wandering ileus produced by large gall stones, the obstruction being due in part to obturation and in part to local spasm.

CASE 2. J. D. C., a white male of 58 years, began to suffer from epigastric distress of a burning nature in June, 1928. The rhythm of the discomfort was typical of peptic ulcer. The attack lasted a few days, vanished for 2 weeks and then reappeared. The patient consulted a physician who prescribed a diet and Sippy powder. The patient followed instructions for several days after which time the pain disappeared. In the subsequent few months he experienced periodic recurrences of his ulcer distress which he was able to check quite promptly by resorting to alkalis. In November of 1928 the symptom of nausea appeared. In December of the same year the first attack of epigastric pain of a severe colicky nature associated with vomiting occurred. The cramp-like pain lasted approximately 3 hours. Similar attacks followed at intervals of one to several days. That the pain was not of ulcer origin was attested to by the following observations. Vomiting did not relieve the pain, the vomitus was frequently negligible in amount and not acid, the taste of alkalis failed to moderate the pain, local heat was most successful in allaying the patient's epigastric colic, the attacks occurred during periods when the patient was free from ulcer distress and at times when the greatest dietary precautions were observed. The gastric analysis revealed slight hyperacidity with a positive test for blood. Three stools obtained on successive days gave a positive benzidine test. The X-ray examination with a barium meal (Fig. 2) demonstrated a persistent napping deformity of the pyloric antrum.

puted as being due to an annular constricting carcinoma

The clinical evidence of benign intermittent pyloric obstruction and the X ray appearance of carcinoma placed us in a dilemma which led us to advise and undertake an exploratory operation. Laparotomy disclosed a thickening of the prepyloric area which lacked the appearance and consistency of a malignant growth and which also failed to reveal an ulcer crater of sufficient size to account for the extent of the induration. Incision over the mass parallel to the long axis of the stomach yielded a firm round object the size of a navy bean which was impacted in the gastric outlet. Just proximal to the pyloric ring was a small ulcer which was partially healed and which had led to a moderate stenosis of the prepyloric region. The stone (Fig. 3) was a white granular oval concretion which measured 1.5 by 1 by 1 centimeter. Upon analysis the gastrolith was determined to consist of carbonates of magnesium and of sodium. The incision into the stomach was closed, a posterior gastro-enterostomy performed and the laparotomy wound repaired. The recovery was uneventful. Within 3 months the patient's weight had increased from 118 to 140 pounds. X ray at this time showed an elongation and variation in the contour of the pyloric canal. Since the operation there has been no abdominal distress to date.

It is difficult to conceive that the clinical picture of intermittent gastric ileus has not been associated previously with concretions in the stomach. Cases of this type have been described but the relationship has not been emphasized. For instance Hamdi reported a unique case of a Turk who on account of a urinary infection took large quantities of salol. During life a tumor which varied in size from time to time was felt on the right side and was considered to be a hydro-nephrotic sac. Postmortem examination disclosed a herniation of the stomach through the right diaphragm and a pure salol concrement the size of a hen's egg within the herniated portion. The attacks of right upper abdominal pain and local distention were probably due to obstruction at the diaphragmatic opening. A dramatic case is mentioned by von Bergmann of a patient who suffered intense upper abdominal pain and presented the picture of collapse. The diagnosis of perforated peptic ulcer was made and laparotomy urged. The operation revealed a cabbage stalk engaged in the pylorus.

The presence of a concrement derived from antacid medicaments raises the question of

the incidence of gastrolithiasis following alkali treatment for ulcer. Apparently the association is extremely rare for in several thousand cases treated by Sippy's method in the past 10 years at the Cook County Hospital this is the only instance in which a stone formed and remained in the stomach although intestinal concretions were occasionally encountered. We have succeeded in finding one other case of concretion in the stomach following treatment for ulcer with large doses of bismuth. Fleiner in speaking of the disadvantages of bismuth therapy mentions a single case of stone formation in the floor of an enormous gastric ulcer the base of which was formed by the pancreas.

ANOMALOUS REDUNDANT FOLD OF PREPYLORIC MUCOUS MEMBRANE

Singularly curious and presumably quite rare is the anomaly encountered in the case to be described below.

CASE 3. C. T. a white man 42 years of age of temperate habits complained of intermittent attacks of vomiting preceded by a feeling of epigastric distress but no actual pain. The first attack happened early in November of 1928 since when the attacks recurred at from 3 to 5 day intervals. Between spells the patient enjoyed complete freedom from symptoms. When first interviewed January 10, 1928 the patient was feeling entirely well his last paroxysm having occurred 3 days prior. Except for a siege of dyspepsia 2 years earlier lasting 3 weeks and disappearing spontaneously the past history was totally negative. There had been no loss of weight strength or appetite. The physical examination disclosed no abnormality. Repeated Ewald meals yielded no free acid. The chemical test for blood in the gastric contents was uniformly negative. Ten successive stools were likewise devoid of occult blood. The X ray (Fig. 4) showed a constant irregularity of the prepyloric area characterized by a pea sized niche on the greater curvature opposite which was a small filling defect. We ventured the opinion to the patient's family physician that the symptoms were due to a prepyloric benign growth which had a ball valve action. We were unable however to reconcile the X ray appearance with the presence of a polypus and were therefore forced to reserve speculation with respect to the type of growth. Laparotomy was recommended since the attacks continued to recur more frequently and with increasing intensity.

At the operation performed February 2, 1928 nothing abnormal could be detected by inspection or palpation of the unopened stomach except for perceptible thickening of the muscular ring. It was

therefore decided to explore the gastric interior for which purpose an incision was made on the anterior surface midway between the curvatures and proximal to the sphincter. Separation of the margins of the incision disclosed an ingrowth from the distal end of the stomach a transverse fold of mucous membrane which had prolapsed into the pyloric ring. The fold which was of semilunar outline sprang from the lesser curvature side of both walls and involved approximately one half of the gastric circumference at its point of origin. It measured 3.5 centimeters in length and had a maximum radius of 2.3 centimeters. On the greater curvature side one could readily reproduce an outpouching of the gastric wall corresponding to the location of the niche seen in the X-ray. The anomalous fold was resected and the resulting defect in the gastric lining closed. Histological examination of the flap of mucous membrane showed a moderate infiltration of the tunica propria by round and plasma cells and eosinophilic leucocytes but no multiplication of the glandular elements. The recovery was uneventful. An X-ray examination 3 months after operation showed the presence of an inconstant pocket deformity in the region of the operation. The patient has been on an unrestricted diet and has had no further digestive difficulty.

Intermittent gastric ileus due to an anomalous redundant fold of mucous membrane having an epiglottis like action is quite unique. A systematic search through the classified indices proved fruitless. More or less accidentally we discovered a case similar to ours in a paper by von Schmieden dealing with the differential diagnosis of gastric ulcer and carcinoma. This author made the statement at the time of writing (1911) that no similar case had been described hitherto. On account of the rarity of the condition a summary of von Schmieden's case seems warranted.

He relates that a woman 27 years of age had experienced 7 months previously severe gastric distress and diarrhoea. Since that time she vomited following each meal. The vomiting increased progressively into such a degree that she could tolerate only light foods in small quantities. Attacks of emesis were accompanied by severe gastric pain. The physical examination was negative except for emaciation. The chemistry of the stomach was normal. The X-ray disclosed in the pars pylorica on the lesser curvature a cone shaped process resembling a finger cot which pointed upward and did not participate in peristaltic activity. At operation a movable soft mass could be felt before the stomach was opened. After incising the gastric wall the mass was found to be a transverse fold of slightly inflamed mucous membrane. It arose from the posterior wall and occupied such a position in

front of the pylorus so as to permit it to occlude the opening in a valvular manner. Above the fold on the lesser curvature was a diverticulum like sac which corresponded to the conical process seen in the X-ray. The large fold of mucous membrane was excised and the resulting defect together with the gastric opening reunited. The operation resulted in complete cure.

No attempt has been made to gather all the possible causes of intermittent gastric ileus of mechanical origin. We have included only those types with which we have had personal experience and in which operative or postmortem confirmation was available. We have omitted for instance because of lack of demonstrable evidence a case of probable volvulus of the stomach in a patient who presented the clinical picture of intermittent gastric ileus but declined operation. Our prime object at this time is merely to direct attention to a symptom complex which heretofore has received less consideration than it merits. We anticipate that in the course of time others as well as ourselves will recognize and chronicle additional causes of intermittent gastric ileus and that eventually a practical classification will be evolved. Since many diagnoses are made only by a consideration of the various possibilities and by a process of deduction a categorical list of the recorded etiologies will serve the same useful function as the current elaborate scheme applied to intestinal ileus. The importance of detecting a local removable cause where a dynamic basis has been falsely assumed becomes apparent at once when the gratifying results of surgery in intermittent mechanical gastric ileus are considered.

SUMMARY

A clinical syndrome consisting of pain in the upper abdomen vomiting of gastric contents distention of the stomach and pyloric obstruction as determined radiologically is referred to as gastric ileus. When caused by a mechanical condition which obstructs intermittently the designation intermittent gastric ileus of the mechanical type is applied. Personal experience has been had with four etiological factors. The most important is the benign pedunculated gastric tumor which acts as a ball valve by prolapsing into the

pyloric ring or which incites vigorous peristalsis leading to intussusception of the stomach into the duodenum. A cauliflower carcinoma with a pedicle located just proximal to the pylorus illustrates the second type of mechanical cause of periodic obstruction to the gastric outlet. The third etiological factor discussed is a gastrolith derived from powders used in the Sippy treatment for ulcer. A coexistent pyloric stenosis prevented the passage of the concrement and occasioned intermittent impaction. The fourth and most unique type of cyclic obstruction was due to an anomalous redundant fold of prepyloric mucosa which acting like an epiglottis produced a discontinuous occlusion of the pylorus. Other mechanical causes of intermittent gastric ileus might be added to the ones illustrated and discussed. The object of the publication primarily is to direct attention to a clinical syndrome which permits recognition of hitherto obscure conditions that lend them selves admirably to surgical cure.

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acids from the total acids. The accompanying curves will demonstrate how the acids behaved in each of the dogs over a period of 3 months.

After the secondary fundusectomies the gastric analyses showed that the acids behaved in a manner analogous to that following the first operation.

Within 3 months the acidities were back to normal and there was little variation in concentration of acids from day to day. The free acidity, however, was still low in all the dogs as was the case after primary fundusectomy.

HISTOLOGICAL EXAMINATION

The tissues removed at these operations were sectioned and stained (by A B P) and showed parietal cells at both the proximal and distal extremities suggesting that in the dog the distribution of these cells may be different from that in man.

Two months after the first operation a secondary fundusectomy was performed a triangular segment of the greater curvature with the scar of the first operation being removed.

The removed tissue was fixed in picric acid and formalin solution. Transverse sections were made through the scar and mucosa in order to determine histological changes if any. The sections were stained by means of the ordinary hematoxylin-eosin method and revealed an orderly healing process.

By comparing the sections prepared from the fundusectomized dogs with sections from

a normal dog there was found no increase in the number of parietal cells along the neck and acinus of the fundus glands.

RESULTS

Mechanically. A primary delay in emptying time. No permanent disturbance in motility emptying time or outline.

Chemically. A primary reduction in total acidity of the gastric juice with a secondary recovery to normal. A reduction in the amount of free acid.

Histologically. Apparently no increase in the number of parietal cells. The presence of an excess of mucous secretion at the borders of the healing scar.

CONCLUSIONS

The evident differences in distribution of the acid-secreting cells in man and in dogs prevents direct clinical application.

The most striking result is the reduction in free hydrochloric acid which may logically be explained by a decrease (by removal) in the number of acid-secreting glands in conjunction with a normal behavior of the antro-pyloro-duodenal mechanism.

This leads to the conclusion that partial fundusectomy is an effective simple conservative anatomical and physiological method of reducing the concentration of free hydrochloric acid in the gastric contents which may be of therapeutic value in certain types of peptic ulcer.

EFFECT OF AN ACUTE CHEMICAL DUODENITIS UPON THE EMPTYING TIME OF THE GALL BLADDER

AN EXPERIMENTAL STUDY¹

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WITH the introduction of a test for gall bladder visuality under the roentgen ray clinical and experimental investigations have been carried out on a broader scale than heretofore and a few of the secrets pertaining to this organ have been revealed. An attempt to explain the physiological factors concerned with the emptying function of the gall bladder composed one of the principal problems. To this end Ivy and Oldberg conducted a large number of experiments and succeeded in extracting a substance from the upper intestinal mucosa which causes contraction and evacuation of the gall bladder when injected intravenously. It has been shown and is quite generally accepted that passage of bile from the common duct is related to duodenal motility and the tone of the sphincter of Oddi. This is to be expected in view of the oblique passage of the common duct through the wall of the duodenum. It has also been shown that when the gall bladder contracts it exerts only about 25 centimeters of bile

pressure whereas the sphincter of Oddi with the duodenal muscle surrounding the intramural portion of the common bile duct may exert a pressure of from zero to 75 centimeters or more. This means that the gall bladder may contract without evacuation if the sphincter of Oddi or the duodenal musculature is hypertonic. Therefore we desired to ascertain by actual experiment if a duodenitis would lead to biliary stasis. With this purpose in mind we devised the following experiments.

EXPERIMENTS

Group 1. Formation of duodenal fistula for producing duodenitis. Dogs of normal and healthy appearance and medium size were subjected to laparotomy under aseptic conditions and duodenal fistulae were produced. This was done by the following method. Through a right rectus incision the jejunum was picked up a few inches distal to the

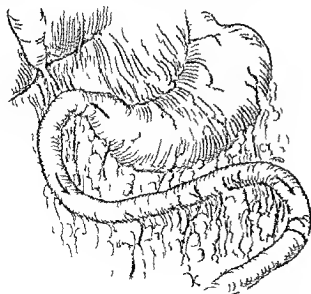


Fig. 1. The area of bowel (lower arrow) to be resected.

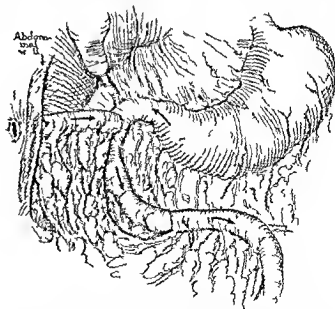


Fig. 2. Operation completed. End to end anastomosis of distal end of resected intestine to duodenum. Proximal end passed through stab wound in abdominal wall and sutured. An end to end anastomosis has re-established the continuity of the small intestine.

Deposited in the Library of the University of Chicago Press, Chicago, Ill., by the author, R. C. Crain, M.D., and E. L. Walsh, M.D., 1934.



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Fig 5 Group 2 Dog 6 July 13 1930 operation—7 cubic centimeters of 0.5 percent aqueous solution of mustard oil injected into duodenum and intravenous injection of sodium tetraiodophenolphthalein July 14 1930 roentgenograms were taken A Before fat meal large gall bladder shadow is present B 1 hour after meal clear shadow somewhat smaller C 2 hours after meal clear shadow smaller D 4 hours after meal clear shadow E 12 hours after meal shadow still visible

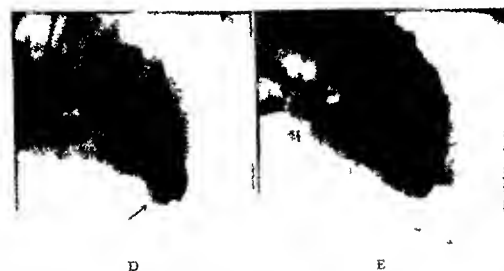


Fig 6 Group 2 Dog 8 Control July 15 1930 operation—7 cubic centimeters of normal saline solution injected into duodenum Intravenous injection of sodium tetraiodophenolphthalein July 16 1930 roentgenograms were made 16 hours after operation A Before fat meal clear gall bladder shadow B 1 hour after meal no gall bladder is visible

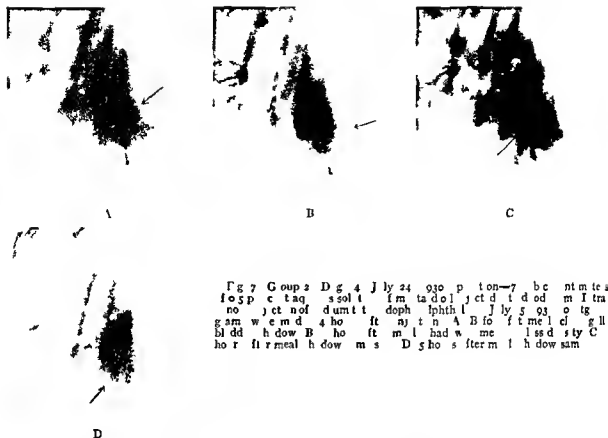


Fig 7. Group 2. Dog 4. July 24. 930 p. ton-7. bc. nt. m. te. a.
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 ho. r. f. r. meal. h. dow. m. s. D. 5. ho. s. f. t. er. m. l. h. dow. sam.

duodenojejunal ligament and a segment approximately 4 inches long was excised the mesentery being left attached. An end to end anastomosis re established the continuity of the small intestine and the isolated segment was then prepared to form a duodenal fistula. The distal end of this piece of intestine was anastomosed end to side to a longitudinal opening of about the same caliber that was made into the duodenum. The attachment of the segment to the duodenum was therefore antiperistaltic. The other end was brought out through a stab wound in the side of the abdomen and sutured. The abdomen was closed and the animal was allowed to recover for a period of 10 to 14 days or longer.

At convenient intervals each of these dogs with fistulae was given an intravenous injection of sodium tetraiodophenolphthalein (0.10 gram per kilogram of body weight) and the gall bladder was visualized 12 to 14 hours later under the fluoroscope. A roentgenogram was made and the animal was given a fat

meal consisting of the yolks of two eggs and four ounces of cream. Roentgenograms were made at hourly intervals after the feeding and the emptying time of the vesicle was noted. We found the dye to be quite toxic for dogs with duodenal fistulae so several days were allowed for recovery. A week later tetraiodophenolphthalein was injected and at the same time a small rubber catheter was introduced into the duodenum through the fistula and 10 cubic centimeters of 0.5 per cent aqueous solution of mustard oil was instilled to produce duodenal irritation. Twelve to 14 hours later the gall bladder was again visualized and roentgenograms were made before and after taking a fat meal.

The results in this group which comprised 10 animals were consistent in each instance. It was necessary to discard some of the findings because of emesis of the fat meal. The majority of the dogs refused the meal and it was introduced slowly with a stomach tube. If emesis occurred at any time during the



Fig 8 Group 3 Dog 1 Control July 2 1930 operation—lipiodol introduced into gall bladder and 7 cubic centimeters of normal saline solution injected into duodenum July 3 1930 roentgenograms made 17 hours after injection A Before fat meal large shadow B 1 hour after meal shadow smaller

following hours when the roentgenograms were being taken the findings were discarded. In the 6 animals retaining the meal the results were always the same. The gall bladder shadow in the control animals disappeared in 1 or 2 hours. When an acute inflammation of the duodenum and upper intestine was produced the gall bladder shadow remained visible for 4 to 6 hours or longer. These experiments were repeated several times on 2 animals.

Each animal was sacrificed a few days after the conclusion of the experiment and the gall bladder and intestinal tract examined. Small pieces of gall bladder and duodenum were removed for microscopic study. Grossly and microscopically the gall bladders showed no pathology. The duodenum jejunum and upper ileum in each case in which the mustard oil solution was introduced showed a marked edema of the mucosa and very small hemorrhagic areas. Under the microscope sections of duodenum showed cloudy swellings of the cells of the mucosa some lymphocytic infiltration and engorgement of the blood vessels.

All of the dogs operated upon in this manner lost weight throughout the course of the experiment and most of them were unable to endure the effects of the duodenitis for long. We therefore took up another plan for producing a duodenitis that apparently had less general effects.

Group 2. Injection of a solution directly into duodenum to produce duodenitis. Laparotomy

was done in each instance with aseptic precautions. Through a right rectus incision the duodenum was exposed and a pursestring suture was placed about a small area on the antimesenteric border. A hypodermic needle was plunged into the lumen of the gut through the center of this area and 7 cubic centimeters of a 0.5 per cent aqueous solution of mustard oil was injected. Upon withdrawal of the needle the suture was tied and the abdomen was closed. In the control experiments an equal amount of normal saline solution was injected. Before each animal recovered from the anaesthesia an intravenous injection of sodium tetratodo phenolphthalein was given. Fourteen to 16 hours later the gall bladder was visualized under the fluoroscope and roentgenograms were made before and after the animals were given a fat meal.

Here also the chief difficulty was emesis of the meal. We used 16 animals in this group and while they were in much better general condition and appeared less toxic than the dogs with duodenal fistulae not all of them retained the meal and therefore such results were valueless. Nine animals which did not vomit gave the same picture as those in Group 1. In the normal or control tests the gall bladder emptied promptly and in the animals with duodenitis it remained visible in films taken 4 to 6 hours or more after the meal. The findings at autopsy were essentially the same as those already described.



A

B

C

Fig 3 G p 3 D 3 J l y 4 93 p t —
 l p dol t d t g l l b l d d e d 7 c b c n t
 m t e s f o s p t q e s l t f m t a r d o l
 j c t d t d d m J l y 5 93 t g g r a m

mad h s a f t j c t A B e f f t m l l g e
 s h d w B h o r f t e m a l g l l b l d d s h d w t h e
 m C 4 h o s i t e r m e l g l l b l d d e h d w t h e
 s m

Group 3 Lipiodol experiments A third series of experiments 5 in number were carried out in which visibility of the gall bladder was made possible by the replacement of the bile with lipiodol. A large hypodermic needle was used to pierce the fundus of the gall bladder the bile was withdrawn and an equal amount of lipiodol introduced. This was followed by an injection of 7 cubic centimeters of 0.5 per cent aqueous solution of mustard oil into the duodenum as previously described and in the control experiments normal saline was used. In a few instances the controls showed that some of the lipiodol was evacuated by the gall bladder whereas there was no change in the gall bladder shadow found in the case of duodenitis.

We favored lipiodol as a medium for observing the gall bladder because it is relatively inert and casts a very clear shadow on the film and is without the disagreeable reaction that not infrequently accompanies intravenous injections of sodium tetradsodophenolphthalein. However the behavior of the lipiodol was not constant and in most attempts there was little difference in the amount of oil evacuated regardless of any inflammation of the duodenum and upper intestine. In one instance autopsy was performed 96 hours after ingestion of a fat meal and the gall bladder contained a thick jelly like mass which would preclude the likelihood of its being expelled. This experience agrees

with that of Ivy and Oldberg who found a similar gelatinous mass in a gall bladder that had been filled with lipiodol preliminary to an intravenous injection of cholecystokinin.

DEDUCTIONS

It seems evident from these experiments that the emptying time of the dog's gall bladder is definitely delayed when an acute inflammation of the upper intestinal tract is present. This may be due to several factors. The marked edema of the mucosa observed at autopsy in those animals having a duodenitis was sufficient to cause in all probability some mechanical obstruction in the region of the sphincter of Oddi or to cause the sphincter to be hypertonic. However Burget, Carlson, Copler and Kodama believe that the most important factor resisting the continuous outflow of bile from the common duct is the tonus of the duodenum. The oblique passage of the common duct through the muscular coats of the duodenum tend to produce a sphincter like action which is dependent upon the tonicity of the duodenum. This latter fact has been shown by the more recent experiments of Lueth. An acute inflammation of the mucosa of the duodenum increases the tonicity of its musculature and hence retards the flow of bile into the intestine. It is also possible that the hormone (cholecystokinin) mechanism is upset by inflammatory changes but in our opinion this

is of secondary importance. It is believed that in the human being in the presence of a duodenitis these factors operate to cause a biliary stasis and delayed gall bladder evacuation.

CONCLUSION

A chemical duodenitis produced experimentally in dogs definitely delays the evacuation of the gall bladder.

NOTE—We are indebted to Dr. A. C. Ivy, Professor of Physiology, Northwestern University Medical School, for his kindness in suggesting this problem and lending valuable advice.

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TRICHOMONAS VAGINITIS IN PREGNANCY

A CLINICAL AND PATHOLOGICAL ENTITY¹

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IN recent years considerable attention has been directed to the significance etiology and therapy of leucorrhœa encountered in the pregnant and non pregnant woman.

The presence of excessive vaginal secretion accompanied occasionally by severe vaginitis in patients registering in our antenatal clinic led us to determine if possible its etiological basis. The frequent observation of actively motile trichomonas in fresh smears of the vaginal secretion of gravid women suggested this organism as the probable causative agent.

Since January 1930 we have been concerned with a clinical and morphological study

of this parasite in pregnancy. In May and June 1930 preliminary reports were presented before the Philadelphia Obstetrical Society and before the Section on Abdominal Surgery, Gynecology and Obstetrics at the annual meeting of the American Medical

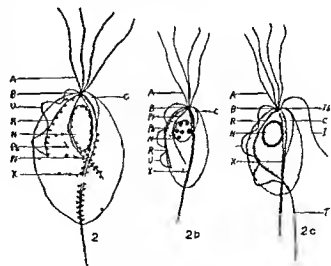


Fig. 2. Diagrammatic drawings (same scale) of trichomonas vaginalis (2a), trichomonas buccalis (2b), and pentatrichomonas dindeitzi (2c). 1, 4 anterior flagella; B, blepharoplast; C, cytostome; I, independent anterior flagellum; N, nucleus; Pb, parabasal body; Pf, parabasal fibril; R, chromatic basal rod; T, trailing flagellum; U, undulating membrane; X, axostyle.

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PERCENTAGE

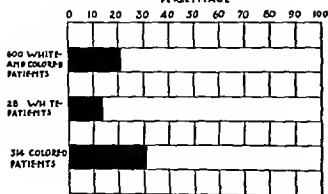
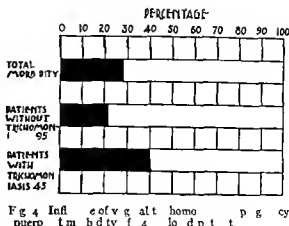
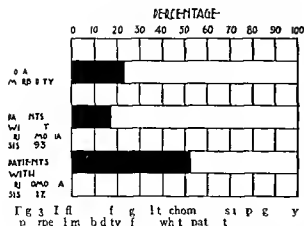


Fig. 1. Incidence of vaginal trichomonas in pregnancy.

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Association The results of the examination of 500 consecutive patients registering in the antenatal clinic of the Jefferson Medical College Hospital were reported. The parasite was found in 118 or 23.6 per cent of the patients. According to race the organism was present in 86 (33.7 per cent) of 257 colored and in 32 (13.2 per cent) of 243 white patients. Only 15 (12.6 per cent) of the patients with trichomoniasis complained of local symptoms although practically all had a rather characteristic purulent leucorrhœa.

The present investigation has extended to include the results of 100 additional examinations together with a comparative morphological study of trichomonas obtained from the vagina, mouth and intestine.

Methods of cultivating the vaginal flagellate were described in our two previous papers (3, 4) and therefore they will not be discussed here. It suffices to mention that a medium composed of sodium chloride, sodium citrate and distilled water with a small amount either of Loeffler's dehydrated blood

serum or fresh human or sheep serum has given the best results.

REVIEW OF LITERATURE

The first account of this flagellated protozoon was published by Donne (11, 12) in 1836 who named it *trichomonas vaginalis*. The findings of Donne were confirmed by Dujardin.

The presence of trichomonads in the vaginal secretion of pregnant and non pregnant women has since been variously reported by numerous authors.

In 1855 Koeliker found the parasite in a yellow cream like and markedly acid vaginal secretion of one half of the gravid and non gravid women whom he examined. Haussmann in 1870 made similar observations and agreed that the organism appears mostly in a thick yellow frothy acid secretion—rarely in a secretion consisting only of vaginal epithelial cells with a few leucocytes. This author discovered the parasite in 40 per cent of 100 non gravid women with pelvic disease and in 37 per cent of 200 unselected gravid patients.

Kuenstler (29, 30) in 1883 reported its presence in a large percentage of pregnant women but rather infrequently in women after the onset of menopause. Hoehne observed the parasite in the vaginal discharge of 34 per cent of 10 gravid and 28 per cent of 104 non gravid patients. In 1913 Brumpt found trichomonas in 10 per cent of the women whom he examined while Seitz in 1919 reported an incidence of 0 per cent in pregnancy. Wille states that of 183 women com



Fig 5 Photomicrograph of trichomonad flagellate

plaining of leucorrhœa 74 (40 per cent) had numerous trichomonads in the discharge.

Traugott noted the protozoon in 18 of 36 non pregnant women who had such pathological conditions as lacerated cervixes, polyps and other diseases predisposing to bacteriological and chemical changes in the vaginal secretion. He also found the parasite in 27 (21.6 per cent) of 125 gravid women. This author reports that the symptoms varied from subjective (i.e. itching, burning and discharge) to objective ones—ranging from reddening of the vaginal mucosa to a typical vaginitis with a purulent and frequently foamy, highly acid discharge.

In a study of 250 patients whose chief complaint was leucorrhœa Reuling observed trichomonas in 46 (18.4 per cent). Ponoschina noted the organism in 16 of 29 women complaining of leucorrhœa. Flaskamp found that only one third of the patients with this type of parasitic infection suffered subjectively. He bases this comparatively low percentage on the observation that many women regard vaginal discharge as a normal process and entirely ignore a slight leucorrhœa.

Hegner observed the organism in 16 of 32 women examined in Honduras and Costa Rica. Schmid and Kammerer found it in 60.0 per cent of 153 non pregnant women. In 19.8 Davis and Colwell (8.9) and Grenhill diagnosed and treated trichomonas vaginalis vaginitis in 38 and 56 private patients respectively. Liss examined the vaginal smears of 326 gravid women without apparent pelvic disease and noted numerous trichomonas in 79 or in 19.5 per cent. M. N. Andrews in 19.9 found the organism in the vaginal discharge of 20 of 100 women studied in England. Recently C. H. Davis, Iurniss, Cary and Holden described instances of vaginitis which they attributed to trichomonas infection.

CLINICAL OBSERVATIONS

The diagnosis of trichomonas invasion in the majority of cases may be made from the physical appearance of the leucorrhœa alone. It is readily confirmed by an examination for living trichomonas under the high power lens or a drop of the secretion mixed with an equal amount of normal saline solution. Clinically

the patient usually complains of a profuse, often very annoying and irritating discharge of long duration extending over a period of months or years. On separating the labia one observes the foamy, purulent, yellow material exuding from the introitus. Reddening and chafing of the vulva and surrounding area are not infrequent. With the aid of a speculum one sees a highly injected vaginal and cervical mucosa with bright or dark red punctate—pepper and salt—mottling and a lake of secretion in the posterior fornix.

In our study smears were made routinely—prior to the thirty-sixth week of gestation—from the vaginal secretion of all patients visiting our antenatal clinic. Trichomonads were found in 136 or 22.7 per cent of the 600 gravid women examined (Fig. 1). This figure also discloses that the parasite is more common in the colored woman, being present in 98 or 30.8 per cent of the 314 members of this race as compared with 38 or 13.3 per cent of the 286 white patients. This variation may possibly be ascribed to racial methods with respect to local hygienic care.

About 18 (13.7 per cent) of the patients with vaginal trichomoniasis voluntarily complained of local discomfort. When closely questioned, however, many others referred to the presence of an annoying discharge. The vaginal secretion was materially altered in all, varying from the normal milky white secretion (consisting of mucus and epithelial cells) to a thick, seropurulent, creamy yellow and often frothy or foamy discharge containing numerous bacteria, trichomonads and leucocytes. If the characteristic leucorrhœa so commonly associated with the trichomonas is considered evidence or at least a prominent symptom of vaginitis, one may safely assert that the majority of patients with trichomoniasis suffer from more or less pronounced inflammatory lesions.

Several of our patients complained of pruritus and chafing in addition to the profuse leucorrhœa. The inflammatory phenomena in severe cases ranged from a diffuse redness or hemorrhagic mottling of the vagina and vestibule with foamy purulent secretion in the fornices to an extensive intertrigo of the vulva and neighboring region. In several cases the

appearance of the vagina resembled except for the frothy nature of the discharge that of an acute gonorrhoeal vaginitis

In only two of our patients was a neisserian infection an accompaniment. Several writers (Loeser, Flakamp, Seitz, Gragert and Furmiss) have likewise recorded instances of dual infection. Hoehne however states that he has never observed a combination of gonorrhoeal and trichomonas vaginitis.

MORPHOLOGY OF TRICHOMONAS VAGINALIS COMPARED WITH OTHER TRICHOMONAD SPECIES OF MAN

In our former contributions (3, 4) reference was made to the lack of understanding with respect to the morphology and life history of trichomonas vaginalis. In these papers however it was possible to extend the knowledge concerning the morphology of this flagellate adding to the descriptions recorded by Blochmann, Kuenstler, Bensen, Reuling and Hegner. It may be of interest now to indicate in what special features trichomonas vaginalis differs structurally from other trichomonad species found in man.

The general form of the various species (Fig. 2) of trichomonad flagellates is similar, being commonly fusiform or pear shaped when the animals are swimming freely in a liquid medium. However the contour is subject to marked temporary variations due to the plasticity of the animals and to the tendency to alter their form in response to environmental changes, especially when they are in contact with solids such as intestinal or cellular debris. Specific distinctions depend primarily upon such morphological characters as:

- 1 The relative size of the animals.
- 2 The number and relative length of the anterior free flagella.
- 3 The relative length and the appearance of the posterior flagellum with the undulating membrane and accompanying chromatic basal rod.
- 4 The structure and length of the axostyle.
- 5 The presence or absence of a parabasal apparatus and its structure when present.
- 6 The size, shape and organization of the nucleus.

7 The presence or absence and distribution when present of chromatic material in the cytoplasm.

8 And finally upon such physiological characteristics as the host to parasite relations and cultural differences.

Trichomonas vaginalis appears to be the largest trichomonad found in the human body, measuring from 10 to 30 microns in length in the living condition with an average length of about 15 to 18 microns. On prepared slides the dimensions are somewhat less; measurements in the present study yielding a range in length of 7 to 23 microns with an average of 13 microns. These measurements do not include the projecting portion of the axostyle. In contrast to these dimensions, measurements of trichomonas buccalis on prepared slides range in length from 6 to 12 microns, averaging 7.5 microns, while for pentatrichomonas ardin delteili from the intestine the range in length is 6 to 16 microns with an average of 9 microns. Thus pentatrichomonas on the average is somewhat larger than trichomonas buccalis. However the measurements for the latter species were made from a single host whereas a number of cases were available for determining the size of pentatrichomonas.

Except for size trichomonas vaginalis and trichomonas buccalis are very similar in organization. Each has four anterior flagella arising from the blepharoplast. In each species the posterior flagellum, the accompanying undulating membrane and chromatic basal rod are relatively short, not reaching as a rule beyond the middle of the body. The structure and relative length of the axostyle in both species are about the same.

The parabasal apparatus in both forms consists of two components: a longer chromatic fibril and a shorter thicker but less dense element. In the two species there are apparently some differences in the second of these components. In the vaginal flagellate the thicker fibril is proportionately longer and sausage shaped, extending usually to near the middle of the body, while in trichomonas buccalis the corresponding element is shorter, being biscuit shaped and located anterior to the level of the center of the nucleus. In both species the thicker component is ordi-

narily invisible and unstained unless special fixatives are used containing chromic or osmic acid. In the material studied there also seem to be differences in the shape and structure of the nucleus in the two types. In *trichomonas vaginalis* the nucleus is usually elongated and flattened and the chromatin although present in a small amount is distributed uniformly throughout the nuclear space in small granules. In comparison the nucleus of *trichomonas buccalis* is often spherical and rich in chromatin and frequently stains so intensely as to obscure the actual structure which includes a few large chromatic masses and a small cariosome. The chromatic granules of the cytoplasm are generally numerous in the vaginal form and ordinarily some are arranged in rows along the axostyle especially in the region posterior to the nucleus along the parabasal fibril and along the chromatic basal rod. In the mouth species such granules are not as evident and as a rule are not arranged in any special manner.

In reviewing specimens from more than 15 cases of intestinal trichomoniasis it has not been possible to differentiate species on the basis of body characters except in the number of flagella. The determination of the flagellar number is at times difficult but in several cases it was observed that the characteristic number of anterior free flagella is five and that these are distributed in 2 groups a single flagellum attached to a small blepharoplast and four flagella attached to a larger adjacent blepharoplast. This flagellar arrangement has been described as characteristic for *pentatrichomonas ardin delteili* by Kofoid and Swezy and others. Therefore the number of flagella distinguishes *pentatrichomonas* from the vaginal and mouth forms since each of the latter two has only four anterior flagella. Other striking differences exist the full length undulating membrane chromatic basal rod and trailing posterior flagellum in *pentatrichomonas* the apparent absence of a parabasal apparatus and of chromatic granules in this species while they both are found in the trichomonads from the mouth and vagina.

Among other species that have been described as found in man it will serve our purpose to mention briefly *trichomonas hominis*

and *trichomonas faecalis*. The first mentioned form is difficult to distinguish from *pentatrichomonas* on any other basis than the difference in number of anterior flagella. *Trichomonas hominis* supposedly has only four flagella. Since the flagella are difficult to count and the independent flagellum is particularly not easy to find in *pentatrichomonas* it is unlikely that the two forms can be separated. Further study is needed to clarify this point.

Trichomonas faecalis has been studied on slides kindly loaned by Doctor L. R. Cleveland who discovered and described this form. This is undoubtedly a different species from any of those mentioned but it resembles very closely and may be identical with a species found in amphibian hosts.

Finally the results of this comparative study indicate that the trichomonads from the mouth, genito-urinary tract and intestine are distinct from each other taxinomically but *trichomonas vaginalis* and *trichomonas buccalis* resemble each other more than either form resembles the intestinal species *trichomonas hominis* and *pentatrichomonas ardin delteili* may prove to be identical.

Trichomonas faecalis is distinct from the other types found in man although it may be identical with a species present in amphibians. Further investigation may disclose a closer similarity between *trichomonas vaginalis* and *trichomonas buccalis*. However it seems certain that *trichomonas vaginalis* is not derived from the intestine.

PATHOGENICITY

Numerous authors have attempted to determine whether *trichomonas vaginalis* is the actual incitant of the colpitis or the leucorrhoea with which it is so frequently associated. At the present time no investigator has succeeded in proving conclusively that the organism is pathogenic though it is the consensus of opinion of those who have studied and treated purulent vaginitis and persistent leucorrhoea existing without apparent cause that it is capable of provoking a morbid condition.

Nevertheless several writers (Haupt, See, Liger, Loeser, Fueth and Wolfing) maintain

that the parasite is merely a harmless inhabitant of the vagina and not in the least pathogenic. Haupt contends that the organism is non-pathogenic because the transmission of trichomonas from the vaginal secretion to a normal woman failed to produce any inflammatory reaction or any change in the character of the vaginal secretion although large numbers of the flagellates were present.

A host of clinicians both here and abroad believe that the parasite has certain pathological proclivities and have pronounced it a causative factor in vaginitis. In this country DeLee, Greenhill, C. H. Davis and Furniss have adjudged trichomonas vaginalis vaginitis to be a specific disease. Seitz and Hoehne assert that the parasite is often pathogenic in nature and that it also tends to increase the virulence of the accompanying bacteria. The latter author was the first to connect this organism with purulent vaginitis basing his opinion upon the fact that trichomonas are found in great numbers in the abnormal discharge and that the vaginitis subsides as the parasites diminish in number.

A frank vaginitis was present in only about 13 per cent of our patients whereas in almost all an altered vaginal secretion was found. It is our contention that the parasite is not merely a harmless and accidental invader of the birth canal but the causative agent of a distinct clinical and pathological entity in a certain number of instances.

VAGINAL TRICHOMONIASIS AND PUERPERAL MORBIDITY

Several authors (Schmid and Kamniker, Liss and Gragert) have studied in detail the effect of vaginal trichomoniasis on the puerperal morbidity rate. The results of these studies are all in accord and tend to emphasize the deleterious effect exerted by this type of infection on the parturient woman.

Schmid and Kamniker for instance reported a morbidity of 10.3 per cent among the women who during pregnancy evidenced trichomonas infection while among the patients free of the parasitic vaginitis it was only 4.8 per cent.

Likewise Liss presents figures on the puerperal morbidity rate of a group of 405 patients

79 of whom had displayed a pronounced trichomonas colpitis during pregnancy (without associated gonorrhoea) and 326 of whom had manifested a leucorrhoea without demonstrable cause. These patients were not treated for the vaginitis prior to delivery. There was a total morbidity of 15.3 per cent among the 326 women exhibiting leucorrhoea without trichomonads as compared with 9 per cent among those in whom the parasite was found. The puerperal morbidity was 11.8 per cent among the patients who were examined vaginally during labor but who had given negative smears during pregnancy. The rate was considerably higher (39.1 per cent) in those with positive smears who were similarly examined vaginally during labor. He concluded that vaginal examination during labor in the presence of trichomoniasis greatly increases the danger of puerperal infection.

Gragert in a similar manner compared the morbidity in the lying-in period of patients who had been successfully treated in pregnancy for vaginal trichomoniasis (i.e. patients finally giving negative smears) with the rate in those who could not be rendered free of the parasite. The rate for those with positive smears despite treatment was 16.4 per cent; the rate for patients successfully treated (parasite free) prior to delivery was reduced to 7.7 per cent. The morbidity in patients without trichomonas infection was 11.3 per cent while the rate for patients with trichomonas vaginitis who received no treatment was more than twice as great (29.1 per cent).

Further to ascertain the influence of vaginitis caused by trichomonas on puerperal morbidity the clinical records were reviewed of patients who had been confined in our institution prior to August 1, 1930. For the purpose of this inquiry every patient with a temperature of at least 100.4 degrees Fahrenheit for 2 successive days or on two different days irrespective of the method of delivery was considered to be morbid. It is not our intention here to discuss the actual causes of puerperal morbidity in our patients but only to determine if trichomonas vaginitis might add to the hazard during the lying-in period.

The records of 50 delivered patients who had been examined for the parasite (untreated

cases) were available for study. Of these 110 were white and 140 were colored. Sixty two (24.8 per cent) of the entire group of 250 had harbored the parasitic infection. This is somewhat higher than the incidence reported earlier for the entire group of 600 patients (22.7 per cent). The percentages according to race correspond in general to those earlier recorded for instance 17 (15.4 per cent) of the 110 white and 45 (32.1 per cent) of the 140 colored patients showed the vaginal infection before delivery.

The number of morbid patients regardless of race according to the standard outlined was 64 (25.6 per cent). These figures appear excessive but if one considers the basis arbitrarily selected for morbidity the percentage is not unusually high. The morbidity in 188 patients of both races who had not manifested the parasitic invasion was 19.6 per cent (37 patients) whereas 27 or nearly one half of the 62 patients who had earlier shown trichomoniasis developed a distinct elevation of temperature after delivery.

Since the morbidity rate for the colored patients was somewhat higher than for the white (Figs 3 and 4) the relation between trichomoniasis and morbidity has been studied in both races. Figure 3 shows that only 16 or 17.2 per cent of the 93 white patients without earlier trichomonas infection were morbid as compared with 9 (53 per cent) of the 17 white women who had manifested the infection. While the total number of white patients with the parasitic condition is small the comparison seems to point to the liability of these women to puerperal complications.

The morbidity rate for the colored is portrayed in Figure 4. Of the 95 colored patients who had been parasite free during pregnancy 21 (22.7 per cent) were morbid as compared with 18 (40 per cent) of the 45 women who had suffered from the infection. It is thus perceived that considerably higher percentages of both white and colored women with vaginal trichomoniasis develop fever in the puerperium than those not so affected. Further investigation is necessary to determine effect of vaginal examination during labor, type of labor and mode of delivery on morbidity rate in presence or absence of trichomonad infection.

From this inquiry it would appear that the presence of trichomonas vaginalis in pregnancy may have a deleterious influence on the puerperal woman. It is not our intention to charge the flagellate as being directly responsible for puerperal morbidity but we are persuaded that vaginal trichomoniasis may have a definite although as yet not fully appreciated influence on the complication. Further investigation of the role played by the accompanying bacteria in the vagina is essential before one may draw positive conclusions as to the exact part held by this parasite in post partum infections. Until this problem is solved we believe that treatment of vaginitis or leucorrhœa associated with the organism during pregnancy should be instituted in order to diminish the danger of puerperal infection.

TREATMENT

Methods of treatment advocated for the relief of the vaginitis and leucorrhœa associated with trichomonas aim either to alter biologically the bacterial flora or to destroy the organism itself by mechanical and chemical means. Prophylaxis may possibly be accomplished by proper cleansing of the anal region after defecation although the intestinal tract so far as the present morphological study would indicate is not the origin of the infection. Repeated treatment is usually required before the vaginitis is relieved and the vagina permanently freed from the parasite.

Whether or not it is wise to institute during pregnancy the local therapy necessary to eradicate the infection may be questioned. Since the parasitic state apparently increases the danger of puerperal infection one would seem justified in attempting to restore the vaginal mucosa to its normal condition during the antenatal period.

Of the different therapeutic procedures employed for the permanent eradication of this infection in both the pregnant and non pregnant woman the one providing the most favorable results in our clinic is in the main as follows.

The vulva and vagina are thoroughly but gently sponged with tincture of green soap and warm water. The vagina is then dried with cotton pledgets and the entire vaginal vault is

swabbed with a saturated aqueous solution of picric acid (one per cent). A one half of one per cent lactic acid douche may be used twice daily for several weeks in order to establish the normal bacterial flora. The employment of a culture of organisms similar to the lactic acid bacillus has been suggested by Loeser. This is claimed to disinfect the vagina biologically and to promote the growth of a selective organism which is antagonistic to others. Other agents and measures may be employed though it is felt that the essential basis of therapy resides largely in thorough mechanical cleansing.

SUMMARY AND CONCLUSIONS

1 The literature on trichomonas vaginalis infection in the pregnant and non pregnant has been reviewed.

2 In our present study the parasite was found in 136 or 27 per cent of 600 gravid women.

3 In none of the patients studied were we able to find the organism within the cervical canal. This section of the reproductive tract we have found as have numerous other workers singularly free from trichomonad infection.

4 According to race the organism was found in 36 or 13.3 per cent of 286 white and in 98 or 30.6 per cent of 314 colored patients.

5 The comparative morphology of trichomonads as found in the mouth, intestine and vagina is presented. From this study it seems that the intestine is not the source of trichomonas vaginalis.

6 Only 18 (1.3 per cent) of the patients with trichomoniasis complained of irritating symptoms although practically all had an abnormal vaginal secretion.

7 From this study it seems one is justified in concluding that trichomonas vaginalis is pathogenic in that it may provoke a purulent discharge characterized by a creamy yellow acid and frothy or foamy nature and occasionally a hemorrhagic or granular type of vaginitis.

8 The effect of vaginal trichomoniasis on puerperal morbidity was studied in 250 patients. The morbidity rate for both white and colored patients who harbored the infection

prior to delivery was found considerably higher than in the parasite free. This would seem to indicate that trichomonas disease may play a part etiologically in puerperal morbidity in a certain number of cases.

9 Finally gravid women with frank trichomonad infection should be treated and rendered if possible parasite free during the antenatal period.

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ABRUPTIO PLACENTÆ¹

M I D W A R D D A V I S B S M D F A C S A N D W I L L I A M B M C G F I M D C H C O
I n t h e D e p a r t m e n t o f G y n e c o l o g y a n d O b s t e t r i c s a t t h e U n i v e r s i t y o f C h i c a g o

THE term abruptio placentæ was suggested by DeLee to designate that serious obstetrical complication in which the normally situated placenta is partially or wholly separated from the uterine wall before the baby is born. Rigby in 1775 first called our attention to the entity of this condition of premature separation of the normally implanted placenta and gave it the name accidental hæmorrhage as distinguished from the other chief cause of uterine bleeding in the last trimester namely placenta prævia. Some separation of the placenta in cases of placenta prævia must be considered a natural accompaniment of the normal mechanism of effacement and dilatation and is responsible for the bleeding which occurs. Rudolph Holmes in an excellent study of this condition in 1901 further emphasized the frequency and clinical importance of this condition and suggested the name ablatio placentæ.

Our present study comprises 164 cases occurring in 40,000 consecutive deliveries during the past 15 years at the Chicago Lying in Hospital. The important literature especially the more recent has been reviewed with the idea of making a more thorough analysis of our cases and presenting them for study in the light of the most recent investigations.

DeLee, Williams, Holmes and the majority of authors separate the cases of abruptio placenta into the mild and the grave depending on the seriousness of the patient's condition. While this clinical classification is very useful it is not entirely satisfactory. The gravity of a patient's symptoms can be interpreted very differently by each of several clinicians. We have used a classification dependent on the underlying pathology, the character and the extent of the placental separation. Because it is sometimes difficult and occasionally impossible accurately to differentiate between partial and complete placental separation we have made use of the patient's symptoms and findings to help in the differentiation. Utero

placental apoplexy is an entirely separate entity and here the diagnosis can be made only at laparotomy or at autopsy.

FREQUENCY

Abruptio placenta is a very common cause of antepartum intrapartum and postpartum bleeding. That it occurs much more frequently than we were led to believe from the writings of many authors is probably due to the fact that many mild or partial separations occur undiagnosed with little or no damage to mother or child. From the literature one gleans the figures presented in Table I.

Once in 244 deliveries in our series represents a fair average. The partial separations occurred in 112 cases or once in 357 deliveries while the complete separations occurred in 52 cases or once in 770 deliveries. Couvelaire's uteroplacental apoplexy no doubt occurs much oftener than appears in the literature. This may be due to the fact that laparotomy is a more recent development and this condition can be recognized only at operation or at autopsy. In our 52 cases of complete separation there were 15 cases that had the typical Couvelaire uterus. This incidence of one in three grave cases is unusual and may not tell the whole story as we do not know how many patients who were delivered from below had typical uteroplacental apoplexy. Harrar found only 1 case in 100,000 deliveries although he performed only 7 cesarean sections in his 64 cases of abruptio placenta.

PARITY

It is generally believed that multiparity is a predisposing cause. Holmes reports 19.2 per cent of his cases occurring in primiparae, Brodhead 1 per cent, Fitzgibbon 10 per cent, Wing 4 or 5 times as common in multiparae. In our series 36.6 per cent of all the cases occurred in primiparae and this agrees with Williams, Harrar, Burgess and others.

We must conclude that parity plays little role in the causation of this condition

ETIOLOGY

Much has been written on this most interesting condition since the earliest contributions of Rigby Goodell and Holmes. However except for calling our attention to its frequency and to its importance little has been added to our knowledge of the exact etiology. Hofbauer in 1926 produced a histamin intoxication in experimental animals and he was able to demonstrate premature placental separations with pathological findings similar to that found in uteroplacental apoplexy. We examined the blood collected at operation from the uterine cavity in a case of uteroplacental apoplexy and found no trace of histamin. Morse in 1918 produced hemorrhagic lesions in the uterus by excessive rotation of that organ so as to interfere with its circulation. Polak in 1924 described a case in which this mechanism of rotation seemed to be the etiological factor for the uteroplacental apoplexy. Browne in 1928 produced a chronic nephritis in experimental animals by the injection of sodium oxalate or uranium nitrate then by injecting bacillus pyocyaneus he was able to produce premature separation of the placenta and placental infarction. He attributed this separation to failure of the kidneys to excrete the poisons from the circulation. While all this work is suggestive it is not conclusive. At the present time the various etiological factors which are ascribed to this condition had better be considered secondary or exciting factors which influence some unknown primary cause.

Winter in 1884 demonstrated the fact that very frequently abruptio placentæ occurs in patients who have some evidences of toxæmia such as hypertension and albumin in the urine. Since that time more and more clinical and experimental evidence has accumulated to bear out this association. Williams found 33 cases of toxæmia in a series of 57 cases an incidence of 57.8 per cent. Kraul in 33.3 per cent. Bartholomew in 55 per cent. Fitzgibbon in 82 per cent. There is no doubt that this frequent association is more than mere coincidence and there must be some

TABLE I — FREQUENCY AND MORTALITY

| N m | Tal d l es | C f b p tio pl te | I d | P t g | P t ge- mat l m t l ty | P t f tal m l ty |
|--------------------|------------------|----------------------------|-------|----------|------------------------------------|------------------------|
| Bodh d | 6 500 | 34 | 485 | | 6 4 | 85 3 |
| Goeth l | 3 | 1 8 | 94 | 6 | 8 6 | 6 5 |
| W g | 60 000 | 64 | 336 | 7 | 5 5 | 80-9 |
| W lso | | 5 | | | 38 | 9 5 |
| P l k | 4 878 | 6 | 3 5 | 3 | 6 | 87 5 |
| F kl d H cso | | 34 | | | 6 4 | 6 7 |
| W lz | | 9 | | | 66 | |
| H rz | 00 000 | 54 | 395 | 5 | 8 65 | 6 |
| C gi | 000 | | 94 | 06 | | |
| W lls m | 9 000 | 57 | 57 | 63 | 7 5 | 7 5 |
| Pha f | | | | | | 00 |
| B gess | 5 7 | 8 | 34 | 43 | 7 5 | |
| F tznbb | 55 000 | 5 | 478 | | 9 5 | |
| O C an | | 37 | | | 6 | |
| Kr l | 5 000 | 7 | 555 | 8 | 7 4 | 6 9 |
| H lm | | | 1 500 | | 9 5 | |
| B th l m w | 9 8 | 6 | 5 | 66 | 6 5 | 83 5 |
| F s d Arm bru t | 3 5 3 | 5 | | 85 | | |
| D 12 d3f Gee | 4 000 | 64 | 44 | 4 | 7 3 | 59 7 |

intimate relationship between the toxæmias of pregnancy and the development of abruptio placentæ. Were it the primary etiological factor in its causation would we not expect it to be most often associated with the most serious of the pregnancy toxæmias eclampsia? Clinical evidence does not support this line of reasoning because we see eclampsia only rarely complicated by premature separation of the placenta. Harrar found this association in only 1 per cent of 650 cases of eclampsia. Goethals in only 4.7 per cent of his cases. Wilson in 8.7 per cent. In our series we saw this association only once in 164 cases of abruptio placentæ. Furthermore it is not commonly associated with the toxæmia that is the result of a chronic nephritis. Rarely is a history of previous kidney disease obtained in these patients who develop abruptio placentæ. Williams found chronic nephritis in 2 of 57 cases. Frankl and Hies in 2 of 34 cases. We had 16 cases an incidence of 9.6 per cent.

TABLE II—A COMPARISON OF ETIOLOGICAL FACTORS IN ABRUPTIO PLACENTÆ

| N m f | N m f | T m p | Ch p t | E m p | T m p | N l p | N l p | Sh l |
|-----------|-------|-------|--------|-------|-------|-------|--------------|------|
| h | se | p | p | p | p | pe | pl g na cy p | pe t |
| If mes | ∞ | | | | 33 5 | 80 8 | | |
| W l m | 5 | 57 8 | 3 5 | | | 7 | | |
| Sed pf | 6 | | | | 7 66 | | | |
| Il | 5 | | | | 5 9 | 66 6 | 7 | |
| Ph f | ∞ | | | | | | | |
| F l k | 6 | 3 7 | | | 8 7 | 8 | | |
| B g | 8 | | | | | 67 | | |
| K l | 7 | 33 | | 3 7 | | | | |
| B h l m w | 6 | 8 | | | | 7 | 8 | |
| h l | 8 | 4 | | 7 | | 69 | | |
| O | 7 | 8 | | | | | | |
| F bb | | 86 9 | | | | 86 | | |
| F kl d H | 3 | 55 8 | | 5 8 | | | | |
| Il fm | 3 | 56 8 | | | | | | |
| W llo | 68 | | | 8 7 | | | | |
| C | | | | | | 65 5 | | |
| B l h d | 3 | | | | | 79 | | |
| N G i | 6 | 36 6 | 9 6 | 6 | 8 | 63 | 9 6 | |

This fact is distinctly opposed to our clinical suppositions for we have always feared the development of this serious complication in our patients who had an old history of kidney disease. Perhaps the infarction and fibrosis of the placenta which is found in patients with chronic nephritis have led us to believe that the mechanism of premature separation would be favored.

In an analysis of our series we found 93 cases that presented some evidences of toxæmia during their prenatal period or during delivery in incidence of 56.6 per cent. Our criteria of toxæmia were a rise in the blood pressure to above 140 millimeters of mercury systolic with a compensatory rise in the diastolic, the appearance of albumin in the urine, oedema and other findings of toxæmia. Eight of our patients gave a history of a toxæmia in a previous pregnancy.

First suggested by Rigby and perpetuated in the older literature trauma was considered to be the most important of the etiological

factors. The original nomenclature accidental hæmorrhage necessarily implies this trauma. Perhaps it was the occasional dramatic case in which the woman received some violent blow or kick on the abdomen and immediately developed a typical picture of grave abruption placente that so emphasized the traumatic element. Perhaps it is the abnormal mechanism of placental abruption from the uterine wall. However in reviewing the literature Table II except perhaps Holmes' 100 cases in which trauma played a part in 67 or 33.5 per cent we find that trauma plays only a very insignificant role. In our own series we could elicit the history of trauma in only 3 cases or an incidence of less than 1.8 per cent. And yet the picture of a woman rushing to the hospital in a taxi cab which collides with another car throwing her forward so that her abdomen receives a violent blow and her dramatic entrance into our clinic in a state of shock and acute anæmia is indelibly fixed in our minds.

Internal trauma as a result of manipulation or operative interferences is more often concerned with the causation of abruption placente than is external violence. In the induction of labor castor oil and quinine pituitrin bags bougies and gauze may cause some injury to the placental attachment, the formation of a retroplacental clot and partial separation of the placenta. Late in labor the descent of the fetus because of an abnormally short cord may cause traction on the placenta and result in its partial separation. The sudden emptying of the uterus in a polyhydramnion or the delivery of the first baby in a multiple pregnancy may interfere with the normal uterine contraction thereby suddenly decreasing the retroplacental area favoring premature separation. Difficult or improperly executed intra uterine maneuvers such as internal version may cause a partial or complete separation. In many cases the signs and symptoms of premature separation do not appear until late in the second stage of labor. This may be due to the marked retraction of the lower uterine segment which is particularly present in long and difficult labors. All of these etiological factors appear in our series but their importance must be

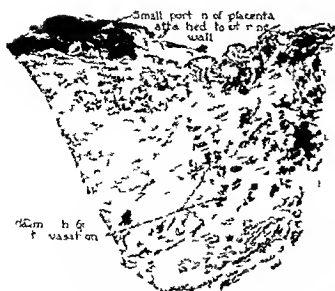


Fig. 1. Section of uterine wall from a case of uteroplacental apoplexy showing extravasation of blood into the uterine musculature $\times 5$.

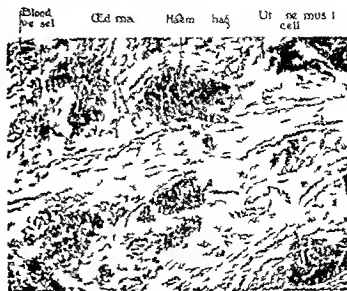


Fig. 2. This section of uterine wall shows extensive hæmorrhage, oedema, and disassociation of uterine musculature $\times 35$.

evaluated separately in each case. Certainly in many of the cases these factors may be entirely incidental and are in no way associated with the underlying pathology.

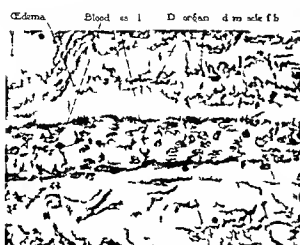
There has been considerable speculation about the role of pathological changes in the uteroplacental union. Diseases of the endometrium or of the myometrium, infarction or inflammation of the placenta no doubt play a role in the causation of this condition. Little information of value can be gleaned from the pathological specimen studied in our series. In spite of the prevalence of syphilis we could find only 2 patients who had positive Wassermann and Kahn reactions.

PATHOLOGY

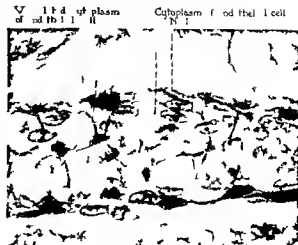
The pathological process begins with a hæmorrhage into the decidua basalis. Whether this initial bleeding comes from the placenta itself or from the small blood vessels as a result of some changes in their walls is a debatable question. The bleeding causes a decidual splitting and the development of a retroplacental hæmatoma. In some cases there likewise develops a hæmatoma in the placenta itself. The extent of the process may become limited and we have a partial separation, or it may continue to extend until the entire placenta has been separated off the uterine wall.

If the process occurs in labor it may be aided by the tumultuous uterine contractions. We have always considered the strong uterine contractions to be the result of the abruptio placentæ. It is easier to believe that the sudden change in the character of the labor is initiated by some other exciting factor and these abnormally strong pains without a sufficient interval of rest between them may originate these premature separations occurring during labor. The retroplacental bleeding may be limited to the uterine cavity by the placenta, the membranes, or a tightly engaged presenting part and it will be entirely concealed. It may rupture through the membranes and into the amniotic cavity and still be concealed, or it may extend to the margin of the placenta, dissect the membranes off the uterine wall and appear externally. On delivery of the child there may be a gush of dark and clotted blood. The placenta will show some area of depression on its maternal surface and to it there may be attached some partially disorganized blood clots. The extent of these findings will indicate the extent of the separation.

Uteroplacental apoplexy first described by Couvelaire and extensively studied by Essen Møller and Williams presents an entirely different pathological picture. Although its exact etiology is unknown, it has been considered toxic or toxic in character because it is so



F 3 Small lcutl t dinally h w g m k d
case size d n mb f dothelial cell h g it
ll X300



F 4 Th sam e sel as figu 3 X600 Th yt
pla m ded and vacuolated Th l pp w l
d hyd op c

often associated with the toxæmias of pregnancy and the pathological findings favor a toxic origin. Grossly the uterus, the tubes and the ovaries and often the broad ligaments present a bluish purplish mottled appearance. This characteristic discoloration may extend to the entire peritoneum lining the pelvis and the lower abdomen in the fatal cases. Sometimes dark free blood is found in the peritoneal cavity having oozed through the fimbriated ends of the tubes or through tears in the serosal surfaces of the uterus and adnexa. The organ is flabby and stretched, having lost the power of contractility. The cut surface is wet and presents a bluish or purplish mottled appearance most marked in the outer and inner layers of the uterine wall.

Microscopically there is present an extensive intramuscular hæmorrhage which has infiltrated the muscle bundles and disassociated the muscle fibers so that they have lost their integrity and their contractile ability. The process is most marked in the inner and outer layers of the uterine wall (Fig 1) but the hæmorrhagic extravasations can extend to the adnexa, the broad ligaments and retroperitoneally. Here and there in the muscle tissue there is present a marked cedema (Fig 2). In advanced cases this appears to be more than a simple cedema, but there apparently is present an actual solution of much of the cytoplasm of the muscle cells. Many of the small vessels

show a marked increase in the size and number of the endothelial cells lining their walls. The nuclei often appear swollen and hydropic. The cytoplasm is rounded and vacuolated (Figs 3, 4, 5). In some of the small vessels there is found a network of homogeneous eosin staining material which does not seem to be fibrin but apparently represents cytoplasm of vacuolated endothelial cells. In the larger vessels these changes are less marked but the endothelium is distinctly swollen. In some of the small vessels this formation of vacuoles separated by homogeneous matrix seems to be more extensive than can be accounted for by hydropic degeneration alone. In some the appearance suggests the presence of hyaline thrombi which have become vacuolated through solution of part of their hyaline material. They look somewhat like thyroid acini in which the colloid has been largely dissolved out. Many of the small vessels are filled with leucocytes chiefly polymorphonuclears and some show mixed fibrin and leucocytic thrombi (Fig 6). The whole process suggests the action of some lytic agent which affects both vascular endothelium and muscle cells in the same way.

SYMPTOMS

The mild type or the partial separation of the placenta usually occurs near the end of labor. The patient may have had a normal

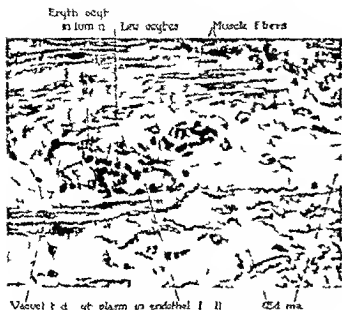


Fig 5 A cross section of another small vessel $\times 270$

course when suddenly the pains become much harder last longer and the interval between pains becomes much shorter. These tetanic contractions are often associated with some rigidity and tenderness of the uterus. There usually now appears some external bleeding and occasionally the passage of a small clot. On auscultation of the fetal heart one finds evidences of fetal asphyxia demonstrated by an irregularity in rhythm or a decrease in rate. The violent character of the labor usually terminates it rapidly but if this does not occur all the findings become more pronounced. The fetal heart tones may entirely disappear if the infant cannot be rapidly rescued. A sudden change in the character of the labor hemorrhage evidences of fetal distress and the finding of old blood clots in the uterus and partially attached to the placenta make the diagnosis of a partial abruptio placentæ.

Complete abruptio placentæ or the grave case presents an entirely different clinical picture. It most often occurs before the onset of labor in fact any time in the last trimester of pregnancy. There are no prodromal manifestations before one or the other of the most common symptoms occur.

Abdominal pain. The onset may be dramatic with sudden excruciating pain in the lower abdomen. It may simulate the pain of a ruptured abdominal viscus. It is usually a continuous pain with little or no relief the patient writhing and rolling. Then again some

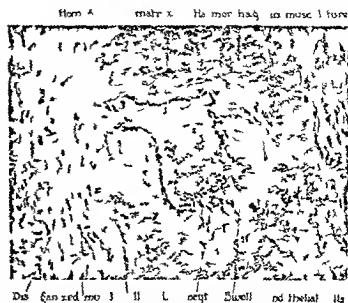


Fig 6 A cross section of a larger vessel showing the swollen endothelial cells lining its wall. The lumen is filled with a homogeneous eosin staining matrix many leucocytes and few erythrocytes. There is extensive hemorrhage and edema in the surrounding uterine musculature $\times 22$

cases begin with a mild dull ache in the abdomen which is peculiarly sensitive. The pain may become more marked as the hours pass and often labor sets in to mask the true picture. The moderate abdominal discomfort is said to be associated with a very slow accumulation of blood in the uterus. The rapid distention of the uterus causes stretching of the peritoneum and the intense pain.

Hæmorrhage. The bleeding in abruptio placentæ is said to be of two kinds concealed and external. In the first type the bleeding occurs behind the placenta or it is concealed in the uterine cavity by the presenting part or the free placenta acting as a tampon for the lower uterine segment. As the case progresses there will be some external hæmorrhage or the expulsion of serum or clots. For this reason we must consider the concealed type as being only the first stage in some cases of abruptio placentæ and that eventually some external bleeding will take place. In our series Table III 18.2 per cent of cases had relatively concealed hæmorrhage during part of their course. Bleeding into the uterine cavity must be recognized early because these are the serious cases in which the patient becomes exsanguinated before the attendant makes the true diagnosis. We can now lay down our first axiom—the

TABLE III—INCIDENCE OF SYMPTOMS IN OUR SERIES

| Symptoms | 5 cases 1 par 1 brup placenta | | | 5 cases 1 par 1 brup placenta | | | 6 cases 1 total brup placenta | | |
|-------------------------|--|----|---|--|---|---|--|---|----|
| | N | % | P | N | % | P | N | % | P |
| Legs cyanotic | 5 | 3 | | 33 | 6 | 5 | 8 | | 9 |
| Rhythm | 86 | 6 | | | | 3 | 8 | | 60 |
| Uterine | | 8 | | 3 | 5 | 7 | 3 | | 7 |
| Tenderness | 9 | 8 | 7 | 35 | 8 | 5 | | | |
| External hemorrhage | | 8 | | 3 | 8 | 6 | | | 8 |
| Coalescent hemorrhage | | 8 | 7 | 9 | 7 | 3 | 3 | | 8 |
| Fetal heart—arrhythmia | 44 | 39 | | | | | 44 | | 6 |
| Fetal heart—bradycardia | | 8 | 5 | 00 | | 7 | 3 | | 9 |
| Admitted shock | | | | 9 | 7 | 3 | 9 | | 5 |

amount of external bleeding is no index of the amount of blood the circulation has lost.

The truth is even more apparent in the case of uteroplacental apoplexy. Here the blood not only accumulates in the uterine cavity but it extravasates and infiltrates into the uterine musculature underneath the serosa between the leaves of the broad ligaments and retroperitoneally. As the condition becomes more and more grave it can be said that the patient is bleeding to death within her own tissues. Some alteration of the blood or blood vessel wall takes place to make this extravasation of blood possible.

Systemic signs of hemorrhage soon develop. The patient becomes more and more anæmic. The mucous membranes become pale and washed out in appearance. The pulse rate mounts the quality becoming progressively poorer. The blood pressure slowly falls. The patient's skin becomes cold and clammy. She complains of faintness, dizziness and occasionally becomes stuporous. The one thing we must remember is that many of these symptoms and findings occur late in patients with sudden and extensive hemorrhage, often too late to institute proper measures if one awaits their development. Our second axiom can now be stated—one must recognize the progressive hemorrhage early, before it is relatively concealed

into the patient's own tissues or external so that timely measures can be instituted.

Shock. Early in the course of some of these cases shock develops. It is often said that the degree of shock is entirely out of proportion to the amount of hemorrhage. It resembles the shock that one sees in the patient with a ruptured gastric ulcer. The shock is most marked in the patients with uteroplacental apoplexy and may be due to irritation of the peritoneum by the hemorrhage beneath it or to the unknown toxæmia. However, our third axiom can be the following—patients with abruptio placentæ do not die from shock but from the hemorrhage and the resultant lack of oxygen carriers in the circulation. Thus a timely blood transfusion in a serious case may often turn the tide of events.

Uterine tenderness and consistency. The ligamentous consistency of the uterus is present in only a portion of the cases. Table III shows 48 in our series or an incidence of 29.2 per cent. It is most often present in the complete separations or grave cases, occurring in 63.5 per cent of our 52 cases. When this marked board-like rigidity of the uterus is present it is pathognomonic of the underlying pathology for very few conditions can simulate it. On the other hand, some of the patients present a soft uterus of a peculiar doughy consistency with moderate or little tenderness. This doughy boggy sensation is given to the uterus by the accumulation of soft blood clots within its cavity.

Tenderness is often associated with the rigidity of the uterus. The tenderness may be elicited over the entire uterus so that the patient will not allow even the most superficial palpation. One of the authors has been particularly interested in this symptom of tenderness to evaluate its significance as an aid to the diagnosis of uteroplacental apoplexy. It has been noted that when the tenderness becomes especially marked, extending more particularly lateral to the corpus in the region of the broad ligaments, it may lend support to the diagnosis of an extravasation of blood between the leaves of the broad ligament and underneath the serosa of the uterus. Tenderness was found in 55.8 per cent of our complete separations.

Uterine motility This obstetrical complication particularly the grave type often occurs in patients who are not in labor. In some of these cases contractions begin and the labor is rapidly completed. Rhythmic uterine contractions of normal severity or more severe than the normal were present in 98 cases or 60 per cent of our total series. However it was present in only 23.1 per cent of our complete separations. More often the board like rigidity of the uterus is due to a tetanic contraction of the musculature the uterus having no periods of relaxation. This tetanic contraction causes constant tenderness and pain to the patient but does not advance the labor by effacing and dilating the cervix. The lack of normal or exaggerated motility of the uterus may mean a paralysis of the uterine musculature as a result of the infiltration of blood within its walls or a constant state of spasm as a result of some exciting factors which often is followed by the extravasations of blood. Clinically we have learned that lack of suitable progress in labor on the part of the patient is a finding of serious import. In our series of complete abruptios 63.5 per cent had tetanic uteri and lack of satisfactory progress in labor.

A study of the blood pressure readings in the prenatal period as suggested by Holmes does not reveal much of interest. A low blood pressure is not necessarily indicative of utero-placental apoplexy although a high blood pressure may be associated with pre-eclampsia. The blood pressure record cannot be used in differentiating the simple placental separations from the grave toxic types.

Changes in size and shape of the uterus In the relatively concealed type the uterus gradually enlarges due to the accumulation of blood within its cavity. If the height of the fundus is greater than the calculated duration of the pregnancy would indicate or if its size increases as the patient is being observed it is of important clinical value in helping to make the diagnosis. In the exceptional cases the fundus becomes irregular in outline due to the accumulation of clots behind the placenta. We have noted that these findings are rare and inconstant. A patient will lose a dangerous amount of blood if one waits for

the gradual increase in the size of the uterus to determine concealed hæmorrhage.

Violent fetal movements are occasionally seen and usually spell exitus for the baby. More often a history of such movements can be elicited from the patient. They represent the last and final efforts of the fetus to obtain oxygen from a failing blood supply because of placental separation. When present they add another link in the chain of evidence in support of the diagnosis of abruptio placente.

Nausea and vomiting are occasionally present and are of little clinical significance except to help cloud the diagnosis. They should not be ascribed to some gastric upset or complaint nor to some acute abdominal condition and the true underlying condition missed. They are probably reflex in origin and represent peritoneal irritation.

DIAGNOSIS

The diagnosis of partial abruptio placente can be made by the sudden change in the character of the labor, the external hæmorrhage and the signs of fetal asphyxia as is indicated by the slowing of the fetal heart rate. Uterine tenderness is often present and may be due to the underlying pathology. After the delivery of the baby there may be a passage of dark liquid and clotted blood. The placenta may have some dark antepartum clots attached to one portion of it and there may be a depression of the maternal surface of the placenta where they have been attached.

The complete separation can be diagnosed by the occurrence of external hæmorrhage in the last trimester of pregnancy associated with abdominal pain of a moderate or extreme severity. There may be present a mild or grave toxæmia. The progressive picture of hæmorrhage rapidly develops. The blood pressure is a better index of the true condition than is the degree of anæmia apparent superficially or on count and a rapid falling blood pressure is a serious symptom. Shock may often be out of proportion to the hæmorrhage. The gradual increase in the size of the uterus and its change in contour may mean concealed hæmorrhage. Marked uterine tenderness and tenderness extending laterally over the region of the broad ligaments

TABLE IV—TREATMENT AND MATERNAL MORTALITY A COMPARISON OF THE TYPES OF TREATMENT AND THE RESULTANT MORTALITY

| T m t | W ho | | B oth d | | P l k | | W l | | B g | | W l l m s | |
|----------------------------|-----------|-------|----------|------|------------|------|-------|------|-------|------|-----------|-----|
| | T tal ase | Dea h | T tal se | D th | T tal ases | D th | T tal | D th | T t l | D th | T tal es | D h |
| C sa sec | | | 8 | 3 | | | | | | | | 3 |
| L p h l my | | | | | | | | | | | | |
| F rr es sec | | | | | | | | | | | | |
| V g l aesa se ti | | | | | | | | | | | | |
| Spo f l l w d by hy t t my | | | | | | | | | | | | |
| F eps | | | | | | | | | | | 3 | |
| Colpe yn | | | | | | | | | | | | |
| C m | | | | | | | | | | | | |
| V cu d | | | | | | | | | | | | |
| D hrs | | | | | | | | | | | | |
| B h tr | | | 8 | | | | | | | | | |
| Spo ta us | 4 | | | | | | 6 | 5 | 7 | | 7 | |
| M l m l pl ta | | | | | | | | | | | | |

may signify uteroplacental apoplexy. The baby is always dead in complete abruptio placentæ.

Placenta prævia, the other chief cause of bleeding in the last trimester, is identified with painless causeless bleeding, the so-called silent bleeding. On examination of the placenta can be palpated in the zone of effacement and dilatation.

PROGNOSIS

The prognosis is dependent on the gravity of the condition when the patient first comes under observation. From the literature we find that the maternal mortality varies from 10 to 50 per cent and is little dependent on the various treatments instituted. Table IV. Furthermore, this terrific mortality has not improved rapidly with our advance in the knowledge of obstetrics. An early diagnosis and immediate institution of treatment are probably the most important factors. In our series the mortality was 73 per cent in the entire group of cases. For the baby the outlook is still worse for all the babies are dead in complete abruptio placentæ and a goodly number are lost in the partial separations. Many are sacrificed in the excitement attending their delivery. The total fetal mortality in our series was 60 per cent.

TREATMENT

A review of the literature reveals the great divergence of opinion as to the proper treatment of this serious obstetrical complication. The lack of agreement on the part of the various authors and clinics and the host of treatments recommended bears out the fact that there can be no uniform treatment. Each case must be individualized and the appropriate treatment instituted. There are however general logical lines of procedure to follow and these can be briefly indicated.

The partial separations or the mild cases most often occur in labor. The labor is often accentuated by the abnormally strong uterine contractions. These cases can be treated conservatively and labor allowed to terminate as near spontaneously as possible. One should carefully follow the patient's condition noting the amount of bleeding, the possibility of concealed hæmorrhage, the character of the labor pains, the blood pressure, the state of the fetus. Gradual increasing asphyxia on the part of the baby characterized by increasing irregularity of rhythm or slowing of the fetal heart rate may mean an increase in the extent of the separation. If the membranes are intact they should be ruptured to make internal bleeding less likely to facilitate the labor and to permit a closer adapta-

TABLE IV—Continued

| T m t | F t g b b o | | K r u l | | B t h l o m w | | G o e t h l | | H a r r | | D v i n d M G | |
|---|-------------|---------|---------|-------|---------------|-------|-------------|-------|---------|-------|---------------|-------|
| | T t a l | D a t h | T t a l | D t h | T t a l | D t h | T t a l | D t h | T t a l | D t h | T t a l | D t h |
| C a s t u | 4 | | | | | | 39 | 6 | 7 | | 4 | |
| L a p t r h l t m y | | | | | | | | | | | 5 | |
| P r r a e s e t u | 3 | | | | | | | | | | 6 | |
| V g l m s s e c t u | | | | | | | | | 5 | 1 | | 1 |
| S p t a n c o f l l w d b y h y s t t m y | | | | | | | | | | | | |
| F p | | | | | | | | | 8 | | 33 | |
| C l p r y t | | | | | 4 | 3 | | | 0 | 3 | 3 | |
| C t m y | | | | | | | | | | | 9 | |
| V d t r t u | | | | | 3 | | | | | | 8 | |
| D h r s e | | | | | | | | | | | 5 | |
| B h t r t u | | | | | | | | | | | 8 | |
| S p t a e o | 8 | 3 | 6 | | 5 | | | | 68 | | 56 | |
| M l m l p l t | | | | | | | | | | | 6 | |

tion of the uterus about the baby thereby decreasing the possibility of hæmorrhage. Tumultuous pains can be temporized by administering some anæsthesia with pains such as ethylene and oxygen. As soon as the labor can be terminated with safety to the mother and to the baby this should be done by the most conservative means. Forceps delivery or version and extraction may be the operation of choice. Immediately on the birth of the baby the mother should receive a cubic centimeter of pituitrin. One need not hesitate to terminate the third stage promptly by a manual removal of the placenta if the hæmorrhage becomes at all alarming.

In the complete separations or the grave cases of abruptio placentæ the treatment must necessarily become somewhat more radical. This is probably the most dangerous condition threatening the life of the pregnant woman and the decision of what is the best plan in an individual case will often tax the most experienced operator. The life of the mother depends on the proper course to be followed. The patient should be carefully studied to determine if we are dealing with a simple separation of the placenta or a serious toxæmic apoplexy. As our experience increases we are able to make this differentiation more and more often. Recently one of the authors was attending a doctor's wife

who had evidences of a pregnancy toxæmia during the latter half of her pregnancy. After she had been in labor for 6 or 8 hours the character of the labor suddenly changed. The pains became more severe and almost tetanic in nature and in spite of this labor did not progress satisfactorily. Some external hæmorrhage appeared. The lower uterine segment became unusually tender and this tenderness was also marked laterally to the uterus in the region of the broad ligaments. The fetal heart rate decreased. This suspicious chain of symptoms and findings made the diagnosis of partial abruptio placentæ with the possibility of an early uteroplacental apoplexy. At cesarean section we were able to demonstrate the infiltration and extravasation of blood into the uterine musculature retroperitoneally and between the leaves of the broad ligaments. Incidentally this is the only case of this kind in which we were able to deliver a live baby. This brief case history illustrates that careful study of our patients will differentiate the serious case from the less serious and the proper treatment can be instituted in each. Many experienced operators have been able to pick out these serious toxæmic cases from the syndrome which they present.

If the patient is in labor and is making normal progress conservative measures may

suffice. Rupture of the bag of waters the temporary dislodgement of the presenting part to rule out the possibility of concealed hæmorrhage and a tight abdominal binder as advocated by Beck may be all that is necessary. The baby is most often dead and needs no consideration. Small doses of pituitrin intramuscularly may hasten the labor and lessen the bleeding. As soon as there is sufficient dilatation the labor may be most expeditiously terminated by forceps version and extraction or craniotomy depending on the existing conditions.

In the patients who are not in labor the fulminating cases who enter in shock the patients in whom labor does not progress satisfactorily and rapidly in the patients in whom a toxic uteroplacental apoplexy can be diagnosed abdominal delivery offers the best results in the hands of those experienced to do major surgery provided proper facilities are at hand. A rapid cæsarean section preferably the low cervical type or laparotrachelotomy and if at all possible under local anæsthesia terminates the labor most rapidly and most satisfactorily. The advisability of a hysterectomy will depend on the ability of the uterine musculature to contract down and control the bleeding. Whenever there is any doubt as to this ability on the part of the uterus to take hold of the situation it had better be sacrificed. We have never had occasion to regret having removed the uterus but we have regretted having left it behind to expedite the operation. While it is not always necessary to do a hysterectomy in all cases of uteroplacental apoplexy it is very often necessary.

Timely treatment is most important in this grave condition. To wait until a patient is exsanguinated and then decide on radical surgery is not fair to the patient or to the method of delivery. The diagnosis of the gravity of the situation must be made early and the treatment instituted early. Every surgeon knows that to operate upon patients in shock is bad practice. Patients who enter in shock must be rapidly prepared before radical surgery is resorted to. Blood transfusions glucose and saline intravenously and subcutaneously and morphia will bring the

patient out of shock and improve her operative risk. Local anæsthesia is the least harmful of all the anæsthetics. If hysterectomy is decided upon the broad ligaments can be rapidly clamped while the transfusion is taking place and the remainder of the operation can proceed more slowly.

The third stage is the most serious stage in the entire labor. Even a mild postpartum hæmorrhage occurring in a woman who is already exsanguinated may be the deciding factor. Furthermore we have noted that patients with even the mild or partial separations have a tendency to postpartum hæmorrhage as a result of an abnormal mechanism in the third stage. Everything should be in readiness for manual removal of the placenta and uterine tamponade. Even before an extraction has been completed or before the shoulders have been delivered in cephalic presentations the patient should receive 1 cubic centimeter of pituitrin. If there is an unusual amount of bleeding following the delivery of the baby and the placenta does not respond to Credé's expression it should be removed manually. Invasion of the uterus is not entirely without risk but is definitely the lesser of two evils. The uterine cavity should be thoroughly explored and all clots removed. Brisk massage and some preparation of erect intramuscularly may be sufficient stimulation to cause the uterus to contract firmly. However if it has a tendency to remain flabby or if the bleeding continues and it is due to uterine relaxation and not to birth injuries tamponade should be immediately instituted. The proper packing of the uterine cavity is very important because it is extremely dangerous when the packing acts as a uterine plug allowing the bleeding to go on behind it. Six to 12 yards of a specially prepared gauze is used firmly to tampon the uterine cavity the cervix and the vagina. If firm packing does not control the bleeding it may mean that we have made an error in the diagnosis and that the uterine musculature is probably disintegrated beyond recovery. Under these conditions a blood transfusion followed by a rapid hysterectomy may still save the patient. Henkel's clamps on the broad ligaments are used in placenta prævia and may be tried as a

temporary expedient to control some of the hemorrhage by clamping the uterine arteries. We have clamped the abdominal aorta by means of a Serfati's aorta compressor or a Momburg's belt but the patients died for these final feeble efforts on our part to stem the tide of events are soothing measures for the attendant who hates to admit defeat.

General treatment to combat the anemia and shock should be instituted early in every case. The frequent use of blood transfusions in the serious hemorrhages of the last trimester is a great step in advance. Blood combats the anemia and the shock at the same time. Every pregnant patient who enters the hospital bleeding should be typed and matched and a proper donor held in readiness. Glucose and saline or Ringer's solution intravenously and subcutaneously will help maintain sufficient volume in the circulation. A sympathetic understanding of the patient herself and her complaints will do much to secure the needed co-operation.

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Fig 5 Loss of following malformation of the nose. At right after the flap is placed on the forehead.

advisability of rhinoplasty and in anticipation of the probable length of time that will be necessary for carrying out the procedure. Because of the less satisfactory blood supply in elderly patients a greater number of secondary operations will be required to insure the blood supply of the flap and the time element will be increased correspondingly. It is difficult arbitrarily to set any definite age limit in such cases as the vessels of one individual may be older than those of another at a given age. As a rule if patients are elderly an artificial appliance for correction of the loss of a nose is preferable to surgical reconstruction. Moreover it is inadvisable to undertake such a procedure unless the patient is in good general health on account of the delayed healing in creased danger of infection and greater possibility of sloughing of the flap.

The extent and situation of the nasal defect are of prime consideration in planning the opera-



Fig 7 Loss of the tip of the nose. At right after the flap is placed on the forehead.



Fig 6 Loss of the tip of the nose. At right after the flap is placed on the forehead.

tion. If the loss has been too extensive to be repaired by tissue from the forehead without including hair bearing skin in the portion that will form the nasal covering it is preferable to secure a flap from some other source. The depilatory measures available at the present time are not sufficiently satisfactory to justify the inclusion of an appreciable area of hairy skin in the flap. The most efficient of these measures roentgen ray and radium in sufficient dosage to destroy the hair follicles are likely to produce pigmentation and other secondary changes whereas electrolysis unless carefully controlled causes increased scarring. Shaving remains the most practical method of dealing with the situation but this is distasteful to the patient and stimulates further growth of hair. When the nasal defect is small and situated at the columella the tip or free border of the ala a flap from the adjacent cheek, upper lip or from the nose itself may at times be utilized to advantage. As a rule however the prominence of the resulting scarring renders this inadvisable. If the lining of the nose and the osteocartilaginous support remain intact so that it is unnecessary to supply a lining the flap can be transferred with much less delay and the end result is better.

The condition of the tissues adjacent to the defect is of importance for if a good deal of scarring is present the flap must be planned to permit of excision of this area at the time the flap is transferred. Thin scar is unsatisfactory for attachment and the line of union will be less conspicuous if the flap is sutured to normal

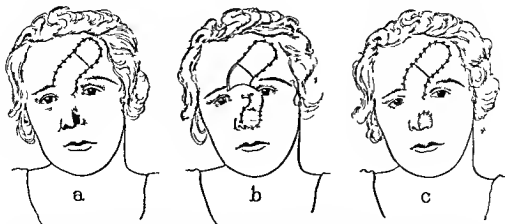


Fig 8 Repair of nose by means of lined forehead flap A Outline of flap with full thickness skin graft lining distal third B distal portion of flap sutured to margins of nasal defect Wolfe graft covering upper half of forehead wound C Repair of nose completed pedicle of flap returned to forehead

tissue The margins of the flap as a general rule should not extend lateral to the normal limits of the nose otherwise the reconstruction is rendered more conspicuous and the nose will have a broad appearance

Although in all cases requiring reconstruction of the nose it is well carefully to consider the advisability of securing a flap for the purpose from some covered portion of the body the forehead with few exceptions remains the site of choice The more satisfactory color and texture of the skin and the greater vascularity and proximity are cosmetic and economic considerations which usually prove deciding factors in this regard A high forehead with an elevated hairline particularly in the temporal region is of distinct advantage Thin skin and lack of subcutaneous tissue render the scar on the forehead inconspicuous if not entirely invisible although such flaps require a longer time for transference because of the lessened blood supply The axis of the flap and its situation on the forehead are determined by the site and extent of the deformity but also by the patient's style of hairdress If the patient is a woman a properly planned flap can often be concealed satisfactorily by dressing the hair over it If the patient is a man the operation practically resolves into a matter of exchanging an unsightly nasal defect for an inconspicuous although as a rule visible scar on the forehead The flap is planned if possible so that its distal portion is free from hair and so the direction of its axis will require the least change for transference The aim is to have the least possible torsion of the pedicle With the defect or scarring extending laterally from the nose the flap can sometimes be advantageously planned with its axis in a horizontal

plane its attachment being in the temporal region on either side This permits of utilization of more of the flap in repair of the lateral area

The preliminary planning of reconstruction of a nose is as important as the careful execution of each operative stage Various methods some of them rather elaborate have been presented for laying out the flap to be utilized Plaster casts and masks of various types have been used for study of the defect and cloth lead foil leather and so forth have been used in preparing a pattern for the flap We have found adhesive tape satisfactory and have used it exclusively for this purpose We make the pattern by actual trial on the face of the patient The patient does not object to it as a matter of fact the tape causes him less inconvenience than does the taking of an impression for a plaster cast

The various stages of the operation may be carried out under either general or local infiltration anesthesia As a rule the primary



Fig 9 Nasal defect together with extensive scarring of the cheek and ectropion of the lower eyelid following removal of an epithelioma At right after repair with fronto-temporal flap

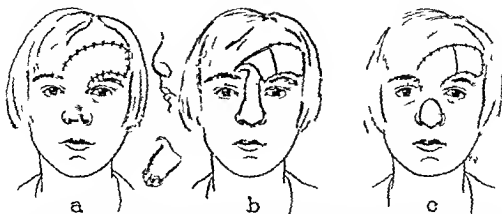


FIG. 13 Reconstruction of anterior portion of nose including the tip with a laton type of forehead flap. A Outline of flap on the forehead. Upper insert shows profile sketch indicating extent of nasal loss. Lower insert shows end of flap folded in to line reconstructed parts and form tip. B distal portion of flap sutured to the nose. Outer half of wound on forehead covered with Wolfe graft. C nasal repair completed. Pedicle of flap returned to forehead.

reconstructed wall of the nose. Frequently at the same time a second Wolfe graft is placed beneath the first in order to supply a covering of skin for the portion of the forehead now overlain by the part of the flap to be used in the reconstruction. These grafts are held in place by transfixing them with the sutures closing the wound on the forehead. A firm pressure dressing is applied subsequently and maintained for 10 days. Grafts buried in the tissues after this manner invariably do extremely well. Barring infection or postoperative bleeding we have never seen one fail to take. At the end of the 10 day period the distal attachment is cut across, the flap is elevated over about two-thirds of its length and again sutured back into its original bed. Following one subsequent elevation of the entire flap a few days later the blood supply is definitely assured and the free end is brought

down and carefully sutured to the margins of the nasal defect and the cheek. Care should be exercised not to make the attachment too far out on the cheek, as has been noted. By this time the margin of the graft lining this part of the flap will have quite closely approximated the cutaneous border at the end of the flap. These will of course unite of themselves within a short time but it is generally preferable to draw them together carefully with fine sutures if this margin is to form the free border of the reconstructed ala. If a forehead flap is utilized in correcting a small defect of the lower part of the nasal ala the lining is best supplied by turning over the distal end at the time the flap is transferred. The pedicle of such a flap can as a rule be cut across and returned to the forehead in from 2 to 3 weeks.

The procedure for total rhinoplasty is in general similar to that outlined for partial recon-



FIG. 14 Loss of anterior portion of the nose following removal of epithelioma. At 11 hr. after reconstruction with a laton type of forehead flap.



FIG. 15 Profile views of patient before loss of most of anterior half of nose and after repair of loss and removal of bony hump.

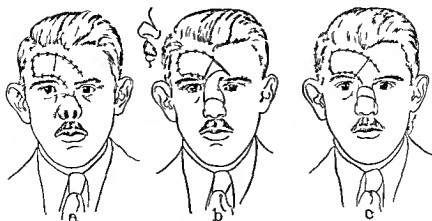


Fig 7 R t uct f u p p t h d f s e b y m e o f l d f h a d f l p
A O t h f f b d f l a p S t p p h g i d c a t s e t t f W o l f g a f t g l s t
shows cut cr s t s s l y d t o p e m u t o f l o w p t n m g d w n
t o p p p t o B d s t l d f l a p s u t u r e d t o p p b o d f l w n s l
s e g m t W l f g r t e p p t w t h d o f f h e d w d C c t r u c
t n c o m p l t d P d e l r t u d

struction of the nose. Difficulty is frequently encountered in securing from the forehead a flap of sufficient size free from hair completely to rebuild the nose. A flap with a trilobed end as described by Nelaton and Ombredanne a number of years ago and recently popularized by Blair serves admirably for this purpose. By doubling under the end of such a flap a columella tip and alæ with an epithelial surface on either side are formed. The presence of hair on the skin forming the lining of the alæ is not undesirable since these are out of sight and in reality replace the vibrissæ. Lining for the portion of the nose above the alæ is supplied by means of a full thickness skin graft buried beneath this part of the flap during the first stage of the procedure. Because of the

marked distal enlargement such a flap must be transferred more cautiously than if the pedicle is proportionately large. Mattress sutures maintain apposition of the doubled under portion of the flap to the overlying skin. The pedicle is as a rule divided in stages after 3 to 4 weeks. A rubber tube is inserted in either reconstructed nostril to maintain its patency. The tube is removed daily for cleansing and is worn for several weeks. Following the return of the pedicle to the forehead and the suturing of the upper portion of the reconstructed nose in position it is necessary to wait for 4 to 6 months to permit the edema and induration of the tissues to subside before an attempt is made further to shape the nose. At the end of this time the excess of sub



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F g 8 L o f l m l l i n o d t o t l
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would make for suction into the vascular system especially during deep inspiration with the consequent increase of negative venous pressure

3 *Lymph borne abscess* Infection by way of the lymph channels may pass freely into or through the interstitial tissue of the lung as has been clearly shown by E. K. Dunham¹ and others. By this process interstitial abscesses of the lung may form either the solitary variety or that characterized by the diffuse condition known as suppurative pneumonitis. The process may develop into larger foci or there may be fibrosis with spontaneous recovery.

4 The *air borne abscess* usually occurs when foreign bodies are carried into the bronchial tree for instance as one of the accidents of swallowing or by direct inhalation of foreign bodies. It seems to me quite probable that the greater number of postoperative abscesses of the lung are produced by aspiration. I will not go further into the discussion of this question of frequency for it has been so often and so thoroughly threshed out in the literature. Perhaps the commonest mode of infection is during operative procedures about the mouth such as tonsillectomy and the extraction of teeth. Suppuration in the accessory sinuses of the nose may produce air borne pulmonary abscesses by the direct entrance of the discharges into the lower airways. Another often unrecognized mode of abscess production is through spillage over into the larynx of the contents of an oesophageal diverticulum. I well remember a case of my own in which I operated upon a woman for fetid abscess of the lung the cause of which was never determined until during the course of a general examination because of a poster Doctor B. S. Oppenheimer of New York. The patient swallowed a contrast meal. The abscess was at once apparent and I then assumed that this had been a monetary infection. The case patient who refused to be operated upon but who knew, once took precautions to wash it men.

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Air borne abscesses are less apt to be multiple than the blood borne although this form of distribution does occur. It is rather important that the possibility of multiple abscesses be recognized because usually when present more than one foreign body may have been aspirated. A case in point has been described by me in which a child aspirated two nut kernels manifestly transparent to the X ray. One kernel was removed by endoscope from the lower right bronchus. The other undreamed of lay in the upper bronchus of the same side. The patient died following lower lobectomy and at postmortem examination the second nut kernel was found in an inaccessible location.

Another source of infection is by blood clot aspirated during operations upon the mouth. The clot unless promptly ejected by coughing will become infected and produce suppuration in the form of bronchopneumonic abscesses or suppurative bronchiectasis.

Tumors of any variety will produce abscesses when by pressure the growths interfere with the free passage of air or secretions through the bronchi. There will be retention and eventually infection through the mouth or by way of the neighboring lymph spaces. Malignant or non malignant growths are equally liable to bring about abscesses by the physiology and mechanism here described. Too often cancer of the lung is not recognized until abscess formation produces symptoms which cannot be disregarded.

TYPES OF INFECTING ORGANISMS

The types of infecting organisms are many and so far as the operative aspect of the case goes the matter is comparatively unimportant. It should of course be recognized that as a general rule the streptococcus forms are more difficult to eradicate than the usual staphylococcus or pneumococcus. It must also be taken into account that any lung which has existed for more than say a year is liable to harbor mixed infection. The or quencing the mouth are almost certain into an infected pulmonary focus and cate the picture by their presence. In addition to the commoner external mure and gas producing bacteria rise to the stench so commonly of the lung. These complications are of importance not only

OPERATIVE TREATMENT OF ABSCESS OF THE LUNG

HOWARD LILIENTHAL MD FACS N Y O K

THIS paper will deal with what may be termed pulmonary abscess by which I mean foci of suppuration not anatomically bronchiectatic in character although in some cases having their origin by way of the air passages. I have chosen this division of the subject of pulmonary suppuration first because I do not wish to overstep the limits of a magazine article and second because the operative treatment of bronchiectasis is mechanically different from that of what I term lung abscess although its physiological principles are the same.

Let us then divide lung abscess into two anatomical types first the interstitial second the bronchogenic. The interstitial has also been known by the name of parenchymatous but the lung has no true parenchyma its substance being made up of alveoli. I term the bronchiectatic abscess one which is formed primarily by the infection and subsequent dilatation of a bronchial branch.

In the nature of the pulmonary structure it is of course quite impossible to conceive of a well developed pus pocket which strictly belongs to only one of these two classes since one form can not exist except in its very incipency without producing changes which would have to be characterized by the other descriptive adjective. Thus a dilated and infected bronchus will infect in its turn the interstitial lymph spaces with more or less necrosis.

CAUSES OF LUNG ABSCESS

The cause of abscess may be anything by which there is produced infection with destruction of tissue. In the case of the lung there are four main avenues for the entrance of infection (1) Traumatism (2) the blood vessels (3) the lymph channels (4) the airways. Interference of bronchial drainage from without the bronchial tree by tumors of any kind may be considered as a cause of air borne abscess.

Let us take the abscesses briefly in their etiological order.

1 *Traumatic lung abscesses* may be produced by wounds passing through the chest wall such as gunshot injuries and punctures. In civil life they perhaps more frequently follow injuries through neighboring hollow viscera especially the œsophagus. Lung abscess resulting from puncture by a fish bone or other sharp object from within the

œsophagus is well known. It is quite conceivable also that a puncture from a foreign body through the viscera below the diaphragm might bring about lung abscess although this must be extremely rare. A traumatic abscess is of the mixed type although theoretically it comes under the head of interstitial.

2 *The blood borne abscess* results from embolic infections through the blood stream for example those which follow surgical incisions through peripheral rigid tissue such as in furuncles. The indurated tissue of the infected focus keeps the veins from collapsing and when their walls are violated there is a tendency for infection to enter the open vascular mouths to be carried to the right heart and thence directly to the lungs. And by the way this is an excellent reason for not treating furuncles by incision a method which I am glad to say has long been given up by dermatologists an example which surgeons are rapidly following. I have observed several cases of this kind one that of a personal friend who a few weeks following the incision of a number of furuncles of the neck became desperately ill and died. At necropsy thousands of minute abscesses were found in both lungs. There were no signs of pneumonia nor was there any cough and this is not surprising when it is realized that the infection was interstitial and that the patient did not live long enough for any of the abscesses to invade the bronchial tree. Another case was that of a patient who following an operation for phlegmon of the arm developed multiple kidney abscesses and also several good sized lung abscesses in both chests. Both kidneys were operated upon for cortical suppuration and the patient was fortunate enough to get rid of the acute pulmonary abscesses without surgical evacuation.

Experiments have been made notably by Cutler and Schlueter to show how the introduction of a capsule filled with pathogenic organisms placed in the lumen of a peripheral vein will be carried to the lung where it becomes lodged and eventually produces an abscess. This of course is exactly what might have been foretold. It is quite probable though almost impossible of proof that in certain operations about the mouth such as tonsillectomy organisms may be carried by way of the venous system straight to the lungs. The indurated tissue and the open veins in this region

would make for suction into the vascular system especially during deep inspiration with the consequent increase of negative venous pressure

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Bulbar paralysis is also a cause provocative of lung abscess since the ataxic movements of swallowing may result in a spillover into the larynx. I have seen one case of this kind. Epileptic convulsions may be accompanied by the aspiration of mouth contents and consequent abscess.

An air borne foreign body which in itself is not infected may however produce suppurative disease of the lungs often bronchiectatic in charac-

ter because of impeded drainage which later becomes infected by organisms from the mouth.

Air borne abscesses are less apt to be multiple than the blood borne although this form of distribution does occur. It is rather important that the possibility of multiple abscesses be recognized because usually when present more than one foreign body may have been aspirated. A case in point has been described by me² in which a child aspirated two nut kernels manifestly transparent to the X-ray. One kernel was removed by endoscope from the lower right bronchus. The other undreamed of lay in the upper bronchus of the same side. The patient died following lower lobectomy and at postmortem examination the second nut kernel was found in an inaccessible location.

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because of the toxins which they produce but because of the extensive and often rapid necrosis of tissue which they bring about invading vascular channels with consequent bleeding which is usually more fatal than the hæmorrhage ordinarily encountered in tuberculosis.

A possible exception is that of Friedlaender's bacillus which seems to have the curious quality of traveling from one part of the lung to another and even from one lung to its fellow. The infections by this organism sometimes have a tendency to resolve spontaneously.

RECOGNITION OF LUNG ABSCESS

Of first importance is the history. All too frequently details are overlooked. For example it is necessary to inquire into the possibility of the patient's having aspirated a foreign body. Did he strangle at table 2 or 3 weeks before? Has there been an operation of any kind in any part of the body including the incision of abscess or boils? In the latter instance weeks may have passed and the patient may have almost forgotten. Every effort should therefore be made to bring out all details of happenings during the previous 4 weeks at least. Often the patient complains of no chest symptoms whatever merely stating that he feels below his usual condition. He may not even have recognized that fever is present. The temperature should be recorded and always by rectum. Some time if the patient is seen for the first time in the morning the thermometer may not indicate anything abnormal but at 5 in the afternoon there may be distinct pyrexia. Cough may be absent until an interstitial abscess has enlarged in the direction of one of the larger bronchi. I recall a case in which characteristic fetor of the breath without cough gave the first hint of suppuration within the lung.

The physical signs in pulmonary abscess are notoriously misleading or apparently absent until the condition is far advanced and even then a surprise frequently awaits one on examining the roentgen films. I would warn against the elimination of pulmonary abscess from the diagnosis until careful roentgenology has been practiced the exposures having been made with the patient in three different positions first with the patient in the erect position with the film front or back—better both second a full lateral exposure with the film against the suspected side third with an antero-posterior or postero-anterior exposure with the patient lying upon his well side. Recently it has even been suggested that an antero-posterior or postero-anterior picture should be made with the patient lying upon his suspected side so that

a fluid surface may not be confused with the cardiac shadow.

Iodized oil introduced within the bronchial system will rarely enter an abscess but this method may still be useful from this very fact since it can outline the bronchial distribution outside the focus the region of which remains blank.

Bronchoscopy is of course of great value principally in determining the branch from which the pus exudes and in cases in which the abscess is not yet connected with the bronchus the deformation from without will indicate the relation of the abscess to the bronchial tube. Obviously foreign bodies may be seen and extracted.

Having determined the presence of a lesion suspected to be an abscess there is for some unaccountable reason a strong tendency on the part of most physicians to introduce an aspirating needle through the chest wall. This should never be done unless all preparations have been made for operation and since many cases in which aspiration seems desirable would do better with operation the aspiration had better be reserved until the chest wall down to the ribs has been incised.

I am well aware that exploratory aspiration for lung abscess is far from uncommon and that the mere fact that disaster has not instantly followed produces the idea that it may be done with impunity. I have seen however a number of fatal cases in which deep phlegmon of the chest wall has been produced directly by the implantation of virulent organisms on the withdrawal of the infected needle from an apparently negative puncture. One such experience should be enough for most of us.

If for any exceptional reason a negative puncture is made by me even to diagnose the pus in an empyema. I always remove the syringe from the needle which is left in place and inject a few drops of pure alcohol while the needle is being withdrawn. The great danger in these cases is that the phlegmon of the chest wall begins in the deeper layers and is seldom recognized until it has reached alarming proportions. And these phlegmons may occur even in spite of thoracotomy and drainage of the abscess through infections of neighboring diagnostic punctures.

PROGRESS OF PULMONARY ABSCESS WITHOUT OPERATION

All abscesses of the lung do not require operative drainage. Many perhaps even the majority of abscesses will resolve spontaneously. Even excavations of considerable size with roentgenologically demonstrated fluid levels may thus heal (Fig. 1). Probably the greatest proportion of

abscesses which get well of themselves are in children

When resolution does not speedily occur there is a tendency for the abscess to spread centripetally into the bronchi or centrifugally through the visceral pleura into the pleural space producing empyema. Opening into a bronchus however does not mean that a cure will certainly follow while the development of empyema merely adds another complication.

CEREBRAL EMBOLISM

Cerebral embolism either of air or of infectious material may occur with or without operative treatment and infectious emboli eventually produce metastases in distant organs such as the kidneys and the spleen. The latter accident occurred in one of my cases during operation for the drainage of an acute upper lobe abscess in which a large branch of the right pulmonary vein was wounded the patient at the same instant taking a deep breath and sucking apparently a quantity of septic liquid (pus) directly into the vascular lumen. Death occurred in 11 hours and the necropsy revealed in even this short time macroscopic hæmorrhagic and purulent infarcts in the spleen, the kidneys and the brain. This case has been reported in full in a paper read on March 9, 1931 before the Southeastern Surgical Congress at Atlanta, Georgia and will be published in their transactions.

PROGRESS AFTER OPERATION

In uncomplicated cases operation by the evacuation of the abscess from without will tend toward granulation and eventually cicatrization with recovery whether the abscess is drained by tube or is treated through a large opening by packing. If there are numerous trabeculae in a cavity connected with a bronchus tube drainage even by the softest black rubber may cause ulceration with consequent hæmorrhage of a particularly atrocious type since the bleeding may continue through the mouth even though the flow into the abscess cavity is stanching by firm packing.

Manifest hæmorrhage during the course of operative procedure must be immediately controlled and there is usually little time or opportunity to check the actual bleeding point by ligatures. Hæmorrhage during the subsequent course however may occasionally be treated by clamping together with electrocoagulation or ligation. In 1 of my cases there occurred a dangerous though not very rapid hæmorrhage several days after operation and drainage. I was able to expose the cavity through a wide incision to find



Fig. 1. Pulmonary abscess following a few weeks after an operation for varicocele. There was copious foul expectoration. Operation was not advised because of short duration of illness. The case proved to be non progressive and complete spontaneous recovery occurred.

the exact location of the trouble and to close the vessel by a suture. In this instance the rib spreading retractor had to be used and the bleeding point was in the mesial wall far from the surface of the chest.

An abscess of the lung perhaps small in size may rupture into an interlobar fissure producing a sacculated or interlobar collection. This is probably by far the most usual form of production of this type of empyema.

If an abscess cavity persists after perforating into a bronchus of considerable size its walls may undergo epithelialization and when the irregularities and trabeculae are thus covered there is produced a condition termed by Sauerbruch *gitterlunge* or to translate lattice lung or gridiron lung a condition which can be cured only by extirpation of the affected part of the lung or by the almost impossible method of complete destruction of the epithelial lining with or without some kind of thoracoplasty.

Whether or not a bronchial fistula extends completely through the chest wall or merely into the abscess cavity there is danger of eventual and usually terminal amyloidosis. The external fistula (bronchial stoma) while apparently merely inconvenient and not dangerous is in reality very far from being so innocent. I have seen a number of these in which serious and even fatal hæmorrhage has taken place. Therefore I consider that



Fig. 3. Spontaneous bilateral bronchiectasis. The right pharynx is markedly enlarged. The left pharynx is normal.

the presence of a permanent bronchostomy except in rare instance is an indication of surgical failure.

SELECTION OF CASES FOR OPERATION

It should be obvious that when an interstitial abscess occurs its evacuation before it opens into a bronchus is an advantage. The mechanics of the procedure can be easily understood when one considers that the wound following the opening of an abscess in the lung which does not connect with the air passages tends to close by the healing of either of its walls and that these walls are driven toward each other by every strong expiratory effort. While if there is a bronchial opening within the abscess air rushes in and out and in a measure prevents the expansion of the lung and the approach of the abscess walls toward each other.

It is unfortunately very rare to have the opportunity of operating in cases in which the diagnosis has been made before bronchial connection has been established. I have had this opportunity only two or three times but the beautiful and rapid healing which followed has been most instructive. In one of my cases a large abscess was evacuated by thoracotomy and quickly healed without cough at any stage of the disease either before or after operation.

As I have repeatedly stated in various papers and in my book on thoracic surgery (already referred to) Vol. II, p. 26 it does not seem reasonable to speak of putrid non putrid acute or chronic abscesses when it comes to deciding upon

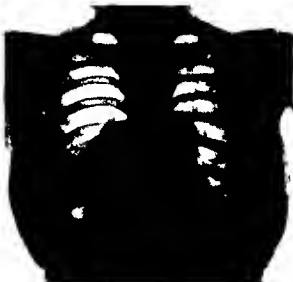


Fig. 3. Spontaneous bilateral bronchiectasis. The right pharynx is markedly enlarged. The left pharynx is normal.

surgical action or inaction. I prefer the descriptive terms progressive, stationary, and retrogressive.

Some surgeons as well as physicians advise delay in operating in acute cases, reserving the surgical attack for those of long standing. If this plan is carried out, however, it must mean that a progressive abscess will not be treated by operation and inevitably if the development continues the result can only be fatal.¹ The rapidity of the progress and the virulence of its accompanying sepsis should be the determining factors in the decision to operate. While I freely admit that the procedure itself is followed by a lower postoperative mortality in chronic or stationary abscesses, yet only a timid respect for statistics would prevent operation in these progressive cases.

This does not by any means signify that all acute abscesses should be treated by operation but merely that their development should be carefully watched so that they may not get out of hand. It is extremely rare for me to advise performing an emergency operation in a case of abscess of only a few weeks' duration. Still the quick collapse of the soft walls of an acute abscess with obliteration of the suppurating space is much more attractive to the surgeon than the gradual healing in the presence of the dense fibrous covering which accompanies chronicity.

¹ Alford, B. K. G. M. H. A. P. H. Int. W. J. N. S. P. 78.

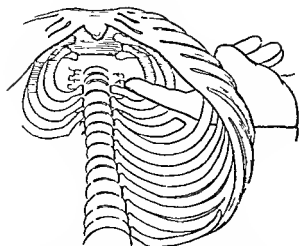


Fig. 4 Showing how far toward the spine the exploring finger can reach when inserted through the second or third intercostal space. It can also nearly approach the apex.

Confronted for the first time with a case of localized pulmonary suppuration one should take all factors into consideration and operate or not according to surgical common sense. The matter cannot be standardized except that abscess of the lung is not usually a condition which demands instant action such as for example strangulated hernia or acute appendicitis.

Frequent roentgenological examination is necessary and if this together with the patient's symptoms indicate retardation of the process to a stationary or even retrogressive type one would certainly advise further delay and if retrogression continues and is not too slow operation may be indefinitely postponed or performed at a time of election.

Much has been said about the preoperative treatment of lung abscesses by bronchoscopy or artificial pneumothorax or both. In the early stages bronchoscopic treatment should certainly be employed for a time but it should not be continued unless there is striking and immediate improvement.

Artificial pneumothorax too may be tested as a form of therapy and even chronic cases have been apparently cured by this method. As a rule however unless there is great improvement within a week or 10 days it is hardly worth while to persist. Low tension pneumothorax is the best form for these cases. If pneumothorax therapy is to be continued however the low tension will have to be gradually replaced by higher pressure. It is unwise to precede this form of therapy by phrenic nerve extirpation because the paralyzed diaphragm is liable to be merely pushed down to its normal position or even below it by the air pressure (Figs. 2, 3).

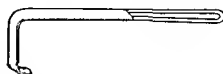


Fig. Blunt retractor with double angle. Useful in exposing the depths of a wound during dressings.

TYPES OF OPERATION FOR THE EVACUATION OF PULMONARY ABSCESS¹

Abscesses of the upper thoracic region. Judging from my own experience abscesses of the upper chest are more common than those in any other part. The most efficient approach is through the axillary region forward or backward according to the previous localization. If there is doubt it may be pointed out that the finger in the second or third intercostal space can reach far enough to enter cavities anywhere in this locality front or back up or down (Fig. 4).

To reach the bony chest wall an incision may be made parallel with the line of the ribs and if necessary nicking the external border of the pectoralis major muscle. If the patient is a woman the breast should be drawn toward the midline by an assistant. The vessels of the external part of the upper thorax are clamped and divided; the nerves conserved if possible by retraction. Blunt retractors are used of the shape shown in Figure 5 because they are not apt to slip.

Having exposed the rib third or fourth the uppermost one of these 2 is cleared for the length of 3 inches. The periosteum is infiltrated with the anæsthetic and the bone scraped bare on all sides. It is then divided with bone forceps anteriorly first then posteriorly leaving the underlying periosteum in view. Now either through the periosteum or in the interspace above it a small incision is slowly made with the scalpel to determine the presence or absence of adhesions of visceral and parietal pleura. If there is a hissing sound indicating an absence of adhesions the patient is requested to strain or if in general narcosis pharyngeal air pressure is made and the opening is stretched with the finger so that by digital examination the exact limits of the adhesions may be ascertained.

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Fig. 6. General catenation of a wound pointing to the pleural cavity. The depth of the wound is about 10 cm.

The operation should then cease and gauze should be inserted into the pleural cavity far enough to make sure that there will be firm adhesion at the next stage. The patient usually has respiratory distress when the pleura is opened, but this will immediately disappear when the wound has been plugged.

The bottom of the wound is now covered with rubber dam and upon this gauze is placed. Each piece of gauze as well as the rubber dam is marked with a suture pin and the entire bunch of material is covered. The skin a few deep interrupted sutures is then put in to hold the packings in place. Upon the suture line is laid a pad of gauze and this is held in place by adhesive plaster running from the midline in the back to the sternum in front but not going farther in order to conserve the breathing space of the well side.

The patient's condition must now be carefully watched and if there is no deterioration and no more discomfort than there was before the operation from 3 to 5 days may be permitted to elapse before inspecting the wound—the longer the period the better. He is then once more taken to the operating room the sutures are removed and all packings except the pleural ones are extracted only now is it permissible to explore very carefully with a large calibered needle and syringe to locate one or more of the abscess cavities.

The X-ray pictures always kept in view especially the ones taken in the lateral recumbent posture will guide us as to the position and extent of the lesion. The needle should be introduced slowly and as soon as it is beneath the surface suction should be begun. If the piston comes back

quickly without resistance we may assume that we are in the part of the abscess cavity which contains air and in putrid cases this can be easily confirmed by the olfactory sense when the syringe has been detached and emptied.

It is not necessary to withdraw pus to insert the needle too deeply might injure vascular structures. The needle should be left in place and the opening gradually enlarged by inserting blunt dissecting scissors with blades closed and withdrawing them open. The patient will probably cough and pus will be expelled. The suction apparatus may be used for the sake of neatness.

Digital exploration now carefully made will demonstrate the size and shape of the cavity. It is preferable to enter the upper part of the abscess rather than the lower for fear of injuring non-adherent pleura and producing empyema. Indeed it is perfectly justifiable at this stage to avoid draining these abscesses from the anatomically lowest point.

If the exploring finger now reveals a cavity extending far below the next rib another rib should be resected and the opening into the abscess enlarged by dividing it in the line of a second cutaneous incision at right angles to the first dividing the intercostal bundle between ligatures so as to have an unimpeded wide aperture into the abscess. I repeat do not try to reach the very lowest part of the cavity for fear of injuring the pleura.

With the aid of suction and strong retraction a good part of the abscess wall can be inspected. It will probably look grayish and perhaps its surface will be shaggy. No effort should be made at this time to simplify the cavity even though this procedure looks tempting.

If there is free passage of air through the bronchial openings so much the better if not this is not the time to secure this ventilation. When there is bleeding within the cavity the patient if conscious should be at once informed that a little blood may appear at the mouth so that he be not alarmed. The blood comes from the wound and passes into the bronchial opening. It simply means that we have succeeded in our effort to produce a free passage between the already open bronchus and the wound.

The abscess should be packed and I have lately been using gauze saturated with one of the polyvalent antigangrene sera. This should be brought in contact not only with the interior of the abscess but also with the walls of the external wound and I have found that there is less tendency to sloughing of the muscles and even of the skin when this serum has been applied.

If there is much motion on coughing or on respiration with a tendency to extrude the packing a pad of gauze should be placed over all and held by firmly applied straps of adhesive plaster for a few days. The foul odor will probably persist for about a week and the cough will continue but the expectoration will diminish. In about 10 days the interior of the abscess should show healthy granulation.

Extremely soft rubber tubes may then replace the gauze but the tubes should not be long enough to irritate the lining of the cavity they are merely put in to prevent adhesion of the wound edges. Gradually the tubes are diminished in number until one large soft tube remains. There should be no haste in permitting the wound to close for fear of retention of discharge and perhaps even of spreading the gangrenous process within. In a month more or less according to the judgment of the surgeon based largely on the quantity of purulent discharge the tube may be removed in the hope that the abscess will become obliterated. With the finger in the cavity and the patient coughing or straining one obtains a good idea of the chances of rapid obliteration (Fig. 6).

When it is not clear that we have a large bronchial opening the test may be made of having the patient breathe while mouth and nostrils are closed. A sufficient bronchial stoma is one which permits respiration through the chest wall in these circumstances.

There need be no disappointment if after the closure of the wound it reopens once or twice. This simply means the temporary replacement of the tube. Epithelization of the sinus from the skin inward and the formation of a true bronchocutaneous stoma results when the tube is left in for a long period. This will usually require another operation for its closure and perhaps even the extirpation of a good part of the remaining wall of the abscess—a description of which is not called for here.

Now to go back to the beginning of the operation. Suppose that there is no apparent opening into free pleura. The procedure may then be continued by opening the abscess at once thus completing the operation in one stage—an advantage to both patient and surgeon. The reason I mention this last is because the former procedure is more common in these operations.

The patient should be informed that for many months possibly even a year there may be a little occasional show of blood in the sputum during a cold. I explain this by assuming that the blood comes from the hyperemic scar tissue which has sealed the bronchus. I have never observed more



Fig. 7 Result after evacuation and healing of upper lobe abscess. The deformation of the scar produced an opacity of this region when observed roentgenologically.

than an occasional streaking. Between colds there should be no cough if the patient has made a full recovery.

Peripheral abscesses in the middle and lower chest. The procedure here is practically the same as that described for upper chest foci but at the very bottom of the thorax many of these abscesses will be found adherent to the diaphragm whether they are peripheral or not so far as the ribs are concerned. In making the diagnosis it is not always easy to differentiate between supradia phragmatic and infradiaphragmatic suppuration. In either case the fluoroscope may reveal immobility of the pleuronic muscle.

In left sided lesions if the examination is preceded by the ingestion of cold carbonated water there is the assurance of the presence of a gastric bubble which clearly delimits the lower surface of the diaphragm.

If the disease is right sided a pneumopentoneum either by needle puncture or in the female by oxygen insufflation through the tubes will suffice. (Method of I. C. Rubin.) Pneumopentoneum of some kind will be particularly important in the chronic cases.

The incision for thoracotomy in the lower chest should begin in the eighth interspace with fairly

generous resection of the eighth and ninth ribs and perhaps even of the seventh. The remainder of the operation is on the same principles as those given in the description of the upper chest procedure—the pleura is packed and the operation is divided into two stages if opening into the free pleural cavity has been unavoidable.

In chronic cases I have been accustomed to make a long seventh or eighth interspace incision employing the rib spreading retractor and freely entering the pleura. The danger of empyema in this part of the chest and in these old cases is much less than when an opening is made from a putrid abscess in the upper part of the thorax. Through this wide incision adhesions will indicate the exact location of the abscess and the ribs directly overlying the abscess can be resected preparatory to the second or drainage stage. The intercostal thoracotomy may then be closed with pericostal and skin sutures care being used to have the lung in contact with the chest wall by means of intrapleural hyperpressure as the last stitch is tied.

No empyema should form and the shock is slight. At the end of 3 or 4 days the area where the ribs have been resected is exposed and the abscess is drained.

Of these two methods I prefer the intercostal incision because of the accuracy of localization and I do not believe that this method is as dangerous as the accidental invasion of the pleura at a primary evacuation of the abscess. Another advantage in free intercostal incision and inspection is that if there are other suppurative foci they will be revealed and can be treated according to necessity.

Upper lung abscesses. Suppurations within the lung near the hilum are particularly difficult to deal with. The diagnosis is less certain and the near proximity of large vessels is another embarrassing complication. Indeed some surgeons have suggested waiting for spontaneous rupture into a bronchus or for the extension of the abscess into a region more easily accessible. Everything depends upon the progress which the disease makes whether it is actually threatening the patient's life or not.

My preference in attacking these abscesses is through a large thoracotomy which permits absolute orientation then a decision may be reached as to opening the abscess at once even with the certainty of empyema or marking the nearest approach usually from in front and reserving the drainage for the second stage.

Standardization is impossible in dealing with these mesial abscesses. Those who are most familiar with thoracic surgery will not object to the preliminary wide exploration. One thing must be fully recognized and that is the danger of injuring the pericardium when the front approach is made.

The principles of the operations for lung abscess are always the same, namely:

- 1 The head of the patient should be lower than his hips.

- 2 Local anesthesia should be used if possible if not some extremely light form of so called analgesia should be used so that the cough reflex may not be abolished and the danger of aspiration into the opposite lung may be reduced. Heavy narcotic dosage and anesthesia by avertin or other drugs should be avoided.

- 3 Evacuation should be by the most direct route avoiding free pleural involvement.

- 4 The drainage opening should be well above the lower limit of the abscess.

- 5 Manipulation of the cavity should be gentle so as to prevent dangerous hemorrhage.

- 6 One should refrain from the natural surgical tendency to simplify multiple abscess cavities at the time of operation.

- 7 The packings should never be so firm as to dislocate the mediastinum.

- 8 Whenever adhesions are feared rubber dam should be employed as a packing.

- 9 The wound pattern makes comparatively little difference but an opening which promises to enter the abscess by the most direct route should be employed with such preliminary or additional incisions as may be necessary for perfect exposure. As a rule chest wall flaps should not be employed even though they apparently permit of drainage at the lowest point because frequent dressings will be necessary and the flap impedes complete exposure.

NASAL ABNORMALITIES, FANCIED AND REAL

THE REACTION OF THE PATIENT THEIR ATTEMPTED CORRECTION¹

VILRAY PAPIN BLAIR M D F A C S AND JAMES BARRETT BROWN M D ST LOUIS MISSOURI
F m th D p tm t f S g y W h gl U sly Sch l f M t St L M

WHEN the milkmaid of poetic fancy informed the impertinent inquirer that her face was her fortune she unwittingly bespoke one of the fundamental truths of our social contact a truth that has its greatest emphasis when the face happens to be a misfortune. On every countenance is the imprint of the soul its aims and its encounters so that he that runs may read. At best however the reading is not always easy and if the page be torn burnt or poorly made the soul might feel that she were unfairly treated and even desire a change. Should remunerative employment or a change in social status be desired this change may become a necessity.

Characteristics The nose is the most conspicuous feature of the face and any exaggeration loss or deformity renders it not only a target for undesired attention but is not inapt to produce deprecatory or disquieting self consciousness. The extent to which individual noses can vary both in size and shape without transgressing the limits of normality is greater than for any other visible part yet to be acceptable each individual nose must bear some harmony toward the features among which it has its setting.

Facial symmetry The large aquiline nose that can so fittingly surmount other features of classic mold becomes an absurdity when implanted upon a piquant face or on a face with a long upper lip or a large lower jaw and chin though the latter is a fitting offset to the large straight nose. A small nose on a very large face can be equally absurd (see Figs 22 and 41).

Function Not only is the nose a dominant factor in determining facial appeal but it has also still more important vital functions in its relation to respiration and to aeration of the paranasal sinuses these functions may be compromised by some abnormality in the form consistency or patency (see Fig 66).

Surgical indications On account either of appearance impaired function disease or of some fanciful reason the surgeon may be consulted as to the possibility or advisability of changing restoring or treating a nose which is not satisfactory. At first thought the task of giving such advice might seem simple compared with that of making the change but this is only relatively true. In re-

building or in changing a nose one is dealing with material facts related to anatomy and physiology and with fundamental rules that have been formulated in regard to the proper ensemble of the facial elements but in passing upon the advisability of the attempt one must also take cognizance of the patient's mental attitude. If that has become a bit warped it can in the end defeat the main objective namely pleasing the patient regardless of the fact that the newly made nose might be surgically and artistically as near perfection as the available material and our skill permit.

Motifs and factors Therefore we may consider something of the psychology of patients who seek facial corrections. As a general working rule the more pronounced the deformity or loss the more apt is a reasonably good result to be acceptable. Fig 1 (see Fig 38) but conversely it is well to be cautious about embarking upon the correction of slight defects (see Figs 8 and 9). Adolescents of both sexes especially those who have no regular employment are more apt to be over particular than are the more matured and a patient's inability to state accurately and succinctly the particular thing that displeases him should excite grave self doubt in the surgeon's own ability to satisfy. This same uncertainty should also excite the suspicion that the accused nose might not be the real fault. Not infrequently a short or an over sized chin is the real but unrecognized offender (Fig 1). It is sometimes difficult to foretell accurately the ultimate reaction but where there is a real question the patient should be given the benefit of the doubt the experienced man is not very apt to make a grave mistake and for the younger one a wrong guess is often productive of much salutary though gruelling education.

Diagnosis and working plan The external nose is made up of a covering of skin and subcutaneous tissue a supporting framework of bone and cartilage and a lining of skin in the vestibule and mucosa in the nose proper. It should give adequate and not too ample breathing space and the size and contour should not be grossly inharmonious with the face. If after an adequate examination and history the surgeon will consider

(Text continued on p 809)



Fig A



Fig B



Fig C



Fig D



F



F3 A



F3 B

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t p t o t y p t c u l
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Fig 4 A



Fig 4 B



Fig 4 C



Fig 4 D



Fig 5 A

Fig 5 B



Fig 6 A

Fig 6 B



Fig 7 A



Fig 7 B

the results of certain operative procedures can be fairly accurately forecast. Plan and check, then operate only when the plan checks right.

Fig 4 A poorly planned attempt. A and C show the condition in which this woman presented herself after she had been worked upon in a city two thousand miles from her home for approximately 3 years by someone who evidently started without an adequate plan. The defect had resulted from some sort of ulceration and its treatment. B and D show the results that were obtained in five operative steps, one of which included the removal of the scarred nose and the results of the abortive attempt at repair. She came twice to our city—once for 89 days and once for 15 days—with a total of but 23 days of actual hospitalization. The economic results of mishandling such as this unfortunate previously went through can be very devastating.

Fig 5 Normal but displeasing. A A dorsal hump on a nose that was otherwise pleasing to the bearer and in which there was no other exaggeration on that would be rendered more noticeable by the removal of the bony hump. In this case a satisfactory result was obtained by the subcutaneous removal of the hump through an incision made within the nostril. More often there is an extra length of nose, a droop of the tip, or a width of bridge that would become more apparent after the removal of the hump and

cause the result to fall short of expectation if not also corrected.

Fig 6 Normal but displeasing. A A normal and otherwise satisfactory nose with disproportionately flat bony bridge. The result shown in B was obtained by implanting a piece of costal cartilage. The pattern for the cartilage was obtained by building up the bridge with clay on a plaster reproduction of the face. Not all flat bridges can be satisfactorily corrected by this simple plan. In addition it may also be necessary to narrow the bony hump, advance the tip, or shorten the nose, or there may be a fault that cannot be overcome by rational surgery.

Fig 7 Patient's wishes versus rules of symmetry. In many the desire for a certain particular change amounts to an obsession and for such it is always safer to follow the patient's expressed desires or refuse to touch the case. We rarely see one that can be talked out of the desire and usually the impression is too deep to be effaced by a mere artistic improvement. It is often a subconscious reaction to derogatory comment. The case shown in A was operated upon because he appeared to be a perfectly well balanced individual who definitely and succinctly stated that he wanted his nose shortened because he was grieved about the tip. He expressed himself as being satisfied with the result but better facial contour might have come from building out the chin and letting the nose alone.



Fig 8



Fig 9



Fig A



Fig B



Fig 11 A



Fig B



Fig A



Fig B



Fig C



Fig D



Fig 13 A



Fig 3 B



Fig 13 C



Fig 3 D

Fig 8 Ill advised surgery apt to be disappointing. From the history in this case it is probable that the original fault was entirely in the patient's disposition toward and not with the nose itself. She underwent an operation of her own seeking to change the shape of the tip. This was done by a man of skill and proved to be fairly satisfactory but she undertook to have just a little more work done by another man. After he had performed four more operations she was in the condition shown. She had complete obstruction of the left nostril and partial obstruction of the right with the whole of the lower part of the nose a hard mass of scar tissue. The only worth while correction here would have been a rather extensive removal of the damaged organ and the making of a new one as was done in Figure 4. To this she was unwilling to submit and most likely went to someone who would do some further tinkering. People who are seeking unneeded and inappropriate changes like glowing promises and fall easy victims to the inexperienced or the unscrupulous.

Fig 9 Distortion from ill advised surgery. This patient falls into the same class as the preceding. After an operation to reduce the size of the nostrils several others had been done to correct the damage resulting from the first. Besides the snubbing of the end and an obstructed air way the tip was covered by a noticeable rough scar. It was the latter that caused her to seek further surgery but she also refused to go through with the procedures necessary to obtain a worthwhile result.

Fig 10 Normal but displeasing. This nose is simply large in every direction and abnormal consciousness of it was supposed to be interfering with patient's accomplishment and utility. Any plan to change it should take cognizance of the fact that the enlargement was in all dimensions and that all should be reduced. To do this the external covering was dissected free from the bone and cartilage as described under Figure 23 and in addition the posterior ends of the intravestibular incisions were continued out and up in the alar labial crease externally. The dorsal prominence was removed and the bony bridge narrowed. The tip was made narrow by removing parts from the anterior ends of the lower lateral cartilages and the columella shortened by an excision of cartilage and skin at its anterior end. A triangle of skin was removed from the posterior extremity of each ala which together with the removal of a triangular piece of the vestibular lining further forward permitted of a reduction in the size of the nostrils.

This result was finally satisfactory to him but the postoperative swelling and subsequent thickening of the tissues persisted a very long time. It was thought that this latter might have been aggravated by an excessive reaction following the use of a rasp to do the bone cutting or to the presence of rasps within the wound. This is the last case upon which we used the rasp to remove a hump.

We have repeatedly observed that the results of attempted reduction of the size of the lower (the cartilaginous) half of the nose were less satisfactory than had been desired due to the fact that reducing the size of the cartilaginous framework and of the lining did not lessen the size of the external skin covering which in this part is thick and rather inelastic. In the case described removal of triangles of skin from the posterior ends of the alae at least partially overcame this difficulty. In none of our cases in which it was necessary to remove areas of the skin coming from the tip or alae have the scars been objectionable. And we have determined that in the future any patients demanding a reduction in the size of the tip (especially women) will be accepted with the understanding that a section of skin might also be removed and that this would leave a detectable but most likely a practically invisible scar.

Fig 11 Too short to be pleasing. This is a profile of one of the hump group in which there was the increased breadth between the eyes and a sharp groove in the tip and as in all of these cases the nose was also short. Besides various procedures to lessen the breadth an inverted V-Y operation was done on the dorsum supplemented by an oblique cut through the septum from the dorsum at the lower border of the bony hump downward and backward to the base of the columella. This lowered the cartilaginous part of the nose and also the lip as will be seen in Figure 2 A and B.

Fig 12 Nasal oddities—total absence. This boy 19 years old was born without an external nose, nasal passages or accessory sinuses but with a well developed nasopharynx. He had the downward turn to the internal canthi that we have observed to be a rather constant accompaniment of a unilateral congenital nasal absence. The correction consisted first in removing both blind tear sacs and raising the canthi by switching a flap from each upper lid second raising a flap to give access to the site of the nasal fossa base at the upper lip. At this same operation with a finger in the nasopharynx and a site on the base line of the skull as guides a tunnel was chiseled through hard and finely cancellous bone corresponding to the position of the natural nasal passages exposing as we proceeded the upper surface of the palate covering until the nasopharynx was encountered behind. This new passage into the nasopharynx was filled with a gauze roll covered with a thin split skin graft taken from the thigh. The flap raised from in front of the bone was sutured so as to extend the floor of the new nasal passage forward thus advancing the upper part of the lip (compare Figures 12 C and D). The external nose was made in the usual way from a forehead flap. The forehead was too low and narrow to give a proper sized flap with the result that the new nose is short and the nostril openings are visible when viewed from in front. The most interesting observation about this case is that in spite of the fact that he had lived 19 years without a nasal passage both his health and his ability to do physical work were enhanced by giving him nasal breathing passage.

Fig 13 Nasal oddities half nose. In this patient the left half of the external nose was absent and the anterior nares was closed by a shell of bone lined with mucosa and covered with skin and soft tissue. Posteriorly the septum rested against the inferior turbinate bone. Correction consisted in raising one flap from the forehead to make the lining of a new ala and vestibule and one flap from left cheek base at the dorsum of the half nose to be used in making the external surface of a new left half. The left nares was opened with a gouge and the passage enlarged with a chisel and the resulting raw areas were lined with skin graft. By a series of subsequent steps the left half of the external nose was formed from the cheek flap and the new vestibule was lined and the cheek defect filled with the forehead flap. The left blind tear sac was removed and the canthus was raised up into place. The unused pedicle of the forehead flap was returned and the defect grafted. The new air way is but partially efficient but he is satisfied with the appearance which was the object of his visit. In a similar case we found a quite ample nasal passage behind a thin shell of bone occluding the anterior nares on one side. Referring to C and D it will be seen that the improvement of the profile was not as marked as was the front view but this operation was done primarily to improve the view that he got in his mirror and thus satisfy him. Had he wished it the whole nose could have been lengthened but at the expense of more complicated operating (Fig 11). In this type of surgery the customer who is the patient may not always be right but if you undertake the correction he must be satisfied otherwise the operation is a failure.



F 4 A



Fg 4 B



Fg 5



F 6 A



Fg 6 B



Fg 7 A



Fg 7 B



F 8 A



F 8 B



F 9 A



Fg 9 B



F 10 A F 10 B

Fig 14 Nasal oddities half nose Another rarity is the condition of a half nose on one side and tubular fleshy mass on the other attached above in the neighborhood of the internal canthus open below lined with a patulous tube of mucosa which might represent either the lining of the missing half of the external nose or the nasal duct. The tears seemed to be drained out through this tube. This condition probably closely related to the half nose shown in Figure 13. In the cases of half nose we have examined there has been a tubercle above the internal canthus (see Figure 13) which correspond in position to the attachment of the mass here shown and if this mass had sloughed off the condition of Figure 13 would have remained. In the correction of this case an attempt was made to use the mass having both covering and lining to reconstruct a patent right half of the nose with the remote hope that this might later continue to grow normally. However the lining proved to be inadequate and a compromise operation was done pending mature growth when a half nose can be made from the forehead. In the course of the operation the lacrimal sac was removed but later it was necessary to remove a much larger blind mucous sac from deep in the face that likely represented the nasal cavity of that side.

Fig 15 Nasal oddities bifid nose Occasionally a child is born with a median cleft in the upper lip which must represent a failure of union of the globular processes of the nasofrontal process. In this patient it appears that the cleft had extended up into the medial nasal process into the rudimentary apex producing a truly bifid nose. In the attempted correction it was found that the premaxillary process had not descended to its natural level but with its developing teeth was found in the intranasal space. This was removed and also a pyramidal mass of tissue with its base outlined by the nasion above the median end of the mucocutaneous line on each side of the cleft below and the two nasal tips laterally with the apex toward the nasopharynx. Removal of this mass left a large nasal cavity lined throughout with mucous membrane communicating posteriorly with the nasopharynx and wide open in front. This was closed by undermining the face tissues until the two halves of the nose and lip could be sutured in the midline. This was a mechanical success but the operation proved too severe and the baby died some time later.

Fig 16 Nasal oddities hind nose In this case the original median lip cleft had been repaired before it came under our observation. There was an almost complete median nose with two nostrils on one side and a complete half nose with its individual median septum on the other. Correction here followed the plan described under Figure 15. Figure 16 B shows a photograph sent when the child was three years old. When mature growth is attained more work will be required to bring the repair up to its greatest possibilities.

Fig 17 Nasal oddities bifid nose A characteristic of this condition is an extensive headth between the eyes which may be the most marked feature. This was described by Greig (Edinb. M. J. 1924 n.s. No 24 p 560) under the name of ocular hypertelorism and was thought to be due to some anomalous overgrowth of the sphenoid bone. We have however preferred to consider the deformity of the frontal and ethmoid bones as secondary to something that occurs lower down in the frontonasal process (see Figs 13, 14, 15, 16 and 17 which show some of the different variations upon which this conclusion is based). Usually there is at least a notching of the tip or an absence of half the nose. In this case there is a defect of one ala only but there is lack of length of the dorsum that seems constant in all.

Fig 18 Congenital oddities retracted tip In the above case the medial wings and the tips of both lower lateral

cartilages are displaced backward. Correction consisted in freeing the columella from the quadrilateral cartilage above and also the lips and cheeks from the maxilla by an incision continuing upward from the buccal fornix. Also the skin covering the lower half of the nose was dissected from the tip and lateral processes of the lower lateral cartilages. This allowed the columella and lips to be advanced and sutured in this forward position.

In other cases the posterior end of the medial wing is buried within the substance of the lip giving a short broad columella and if this is very marked it is necessary actually to lengthen the columella to make a satisfactory correction. One plan of doing this is by including a trefoil flap from the surface of the lip with the liberated columella or by using material from some other source (see Figure 62). Sometimes the result can still further be improved by putting a cartilage cantilever in the dorsum.

Fig 19 Congenital oddities retracted tip In this case the columella was actually short. In the correction nothing was done to lengthen the columella itself but it and the lip were advanced as far as practicable and the tip was made still more prominent by the use of a cantilever cartilage insert. To give greater lumen to the nostril the central part of the lip that protrudes forward to supplement the columella was made narrower from side to side by excising a wedge from the thickness of the lip base toward the anterior nasal spine and ed subcutaneous at the base of the columella. This was all done at one operation.

Fig 20 Nasal oddities retraction of nasal foundation Lack of forward progression of the parts of the superior maxillary bones that border the anterior nares will cause a retraction of the nose and a somewhat bifid face. If the lining of the nose is not too short a satisfactory correction can be made by simply advancing the cheeks lip and columella on the underlying bone and cartilage and late supplementing by a cartilage insert in the dorsum.

Fig 21 Nasal oddities retracted foundation Short lining. If in addition to the retraction of the bony foundation there is very great shortening of the nasal lining this will have to be supplemented to make a satisfactory advancement. In this case the lip and face tissues were freed from the underlying bone and the full circumference of the nasal lining and also the septum were divided completely through at the anterior nares. This allowed the nose to be drawn forward with a resulting annular defect in the lining. This defect was filled with two ends of a two-tailed pedicle flap raised from the left arm and let in under the lip the arm being held in position with plaster of Paris and the nose held forward to a bar attached to a dental splint. When the flap had healed in place the pedicle was cut and adjusted to the floor and the fornix of the lip was sutured. The defect in the septum was disregarded. Later the bridge was filled out by a cartilage insert.

Fig 22 Nasal oddities retracted foundation and nasal deficiency In this case in addition to the deficiencies described in Figure 21 there is an actual lack of substance in the upper half of the nose requiring not only a piecing out of the lining in front of the anterior nares but also a supplementing of the skin and subcutaneous tissues over the bony bridge. This was done by the use of a two-tailed flap taken from the forehead and let in through a semilunar cut made across the hind end. On each side the ends of this cut extended down well into each ala labial fold and the thus outlined flap below was dissected from the underlying perosteum as far as the freed edge of the bony bridge along which the incision cut through the lining and the septum. The forehead flap was let in through this incision and on each side one tail sutured into the lining along both its borders the two distal ends being brought together in the midline of the floor. This allowed the tip to drop down and



Fg A

Fg B

F 2 A

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Fg 23 A

Fg 3 B

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m g p t of the ped cl wa t do er and sed t
fill the d f t the d r s m A th 3 week l t the
t e wa cut d ma g p d cl w g t d to th
h d nd th fo head defect w g fted N cart
s d d Note that b ngi f r w d th s d
t t n f th ppe l p all ws n th l w l p t
m pl g co to r

f N l d i t e n al defic y I th
l t m h e t c t e d a n Fgu d
l t m h d f e c y of the h w d
l t t h t b th l n g a d n This
t t b j t ly b j c t e l y a m m a t n a l
f m g l y th typ of wo k h d e d d
t h l t t t d h m d which he d d b
t t t t Th t n wa th

f s f th g l type t
t d f m l d g d l n wh h
t t l g w e e f y th g mad
g the h ght fth b d with t
l g l l e H we r m e h it
p l t l p t t we l e t g at th t
h d 4 f th d spl ceme t A a d C sh w a
h l d y l d h w a s p e o ly rece ed a h l w
th h k b th l w p a t of the q a d a t e c a t
l g d t g th l m l a d e t b l l g Th
d w t h t p f th p w d a d th col m l l had
t t e d b w th l t t h e th l p Op n
g th s c th l m l g e a c c e t t h p t m d
t f d th t h q d t c t l g had h p l t t
t p l t Th g h t h l f w p h d t u l t b
stru t d th n h t e s t b l d the low d f th th
w s c l d p w d b m c l y c a g m p l t b
struct th left d at th j c t n f th t b u l
with th n s a l p s a g Th e t w t e d m th r
prope l t g u g th r e l t h w n B d d with
f e e way H d th n t b e n d e l y d i t n f
th p t m s o m w h t s m l t t h t d s c n b e u d
Fgu 26 w l d h s l d

Fg 25 Tra m w th d pl m t A A d g m m a t c
rep sentat o h o w n f a p p o e d s e c t n th g h the
p o t n o r l m u t f the t b l n a t h d h d a
r u h g i n j u r y f th b d d m p l g f th q u d
rat c a t l g w h h d b e n a l e d t h l w th u t e
p l g th d t t e d t l f a t h d g d n a n
i n d e q a t e w y B Sh th m n w b h m e

h th g p was obta ed The obl q ly t n p e
cent n A p t s th s p p o t g t t h l b o
d l t l c a t l g i B th s h n h a n g b e
cut th o g h n h d w th h l w h b a f t e th
r u h d p t u m w t d l l d th b o y d c t u
l g b n d r g to b d p w d th g the
b th p c e v e t i c a l l y Th t r s d t t e d l n m
A e p t n c s th g h t h q d t c a r t l g
d t m c c o e n g s w h i c h a t e l y d p o t n l y
m t w i t h t l n c s o s e t e d f m d t r f
Th m c f l p o t l n e d by th s H s h p d w
r a d f m th d l y g c a r t l g e u p d d o n
w d a d a f t m g the i n t e r e g c r t l g the
t w p p e r f l a p w t d a c o s s a t (1) t c m p l t e
f d th t w l w (2) to c o m p l e t e th f i o f th
n a l y f m e d a n l g d g l e b e a t h g c t y S h
n w l y s d b d g e t h l d p l c e u t l b y s l d
t n t k p c b y a s p l m t e d to the p p t e e t h
Th j u t e e a m p l f n m e o s p l t h a t h
b e e n s o d t n the t e d s f o r t o t e l a t a
b a t h p t h t m g h t h m c h m a l y h
p d m m d t l y t e r t h j y

F 26 T m w th d s p l c m n t A Sh o s t r a l
p p c r s l t g f o m a d e p d f c t t h m l
n 6 m t h f t t h e j r y Th d e p o f
th h y h r d g a d f th u p p e l t a l c t i l a l
th t l t o f t h w a y d the c r u m p l d p t m
d s c n g f t h e l g c e l d e d t h r e m d A f t
th l g t h f t m e t h w n o t h g t f a t t e m p t o
p l a c t h d t t e d s e p t l f m t a d c l c b
m c o c t o l o o k e d l m o s t q a l l y m p t a b l
N t e m p t w m d e t f n d t h d e p e d b o y
h r n d g h c u f t h e l e g t h f t m t h a t w l d h b e
q d t g t b o y f a t t h t w l d b a d e q t p
m t l y t o b l d t h p l a c e d a s l b o n e s s p o r t e d b y
th q d n t l c t l g The a w y w s f e d b y e
m t h l w e d t e d p t o f the s p t m w i t h s o m
f i t n g m u c s a b t a w s f r a c w e l f t b c
L a t p c f c t a l c a r t l g w a s m p l t e d t h d
s m V t t h t h t l e t n a g g d k f r o m
c a t l a g m p l t t o t h d o s m t h e d t n t
r o d g f t h t p f t h e w h s p t t h m e o
l s b j t h l y e v d t i n a y c a n h c h the t e m p t
m a d t h l d t h t p f r w a d b y m s f c t l a g t u
l t h t g t s b n g f m h g h e r p o t h h n d g

Fg 7 G w h d t o t Th c h l d c e d b l o w
n t h n a b l d n g c u r d t h d p l a m t
w S o m m t h l a t t w o b e d t h a t n

h th g p was obta ed The obl q ly t n p e
cent n A p t s th s p p o t g t t h l b o
d l t l c a t l g i B th s h n h a n g b e
cut th o g h n h d w th h l w h b a f t e th
r u h d p t u m w t d l l d th b o y d c t u
l g b n d r g to b d p w d th g the
b th p c e v e t i c a l l y Th t r s d t t e d l n m
A e p t n c s th g h t h q d t c a r t l g
d t m c c o e n g s w h i c h a t e l y d p o t n l y
m t w i t h t l n c s o s e t e d f m d t r f
Th m c f l p o t l n e d by th s H s h p d w
r a d f m th d l y g c a r t l g e u p d d o n
w d a d a f t m g the i n t e r e g c r t l g the
t w p p e r f l a p w t d a c o s s a t (1) t c m p l t e
f d th t w l w (2) to c o m p l e t e th f i o f th
n a l y f m e d a n l g d g l e b e a t h g c t y S h
n w l y s d b d g e t h l d p l c e u t l b y s l d
t n t k p c b y a s p l m t e d to the p p t e e t h
Th j u t e e a m p l f n m e o s p l t h a t h
b e e n s o d t n the t e d s f o r t o t e l a t a
b a t h p t h t m g h t h m c h m a l y h
p d m m d t l y t e r t h j y

F 26 T m w th d s p l c m n t A Sh o s t r a l
p p c r s l t g f o m a d e p d f c t t h m l
n 6 m t h f t t h e j r y Th d e p o f
th h y h r d g a d f th u p p e l t a l c t i l a l
th t l t o f t h w a y d the c r u m p l d p t m
d s c n g f t h e l g c e l d e d t h r e m d A f t
th l g t h f t m e t h w n o t h g t f a t t e m p t o
p l a c t h d t t e d s e p t l f m t a d c l c b
m c o c t o l o o k e d l m o s t q a l l y m p t a b l
N t e m p t w m d e t f n d t h d e p e d b o y
h r n d g h c u f t h e l e g t h f t m t h a t w l d h b e
q d t g t b o y f a t t h t w l d b a d e q t p
m t l y t o b l d t h p l a c e d a s l b o n e s s p o r t e d b y
th q d n t l c t l g The a w y w s f e d b y e
m t h l w e d t e d p t o f the s p t m w i t h s o m
f i t n g m u c s a b t a w s f r a c w e l f t b c
L a t p c f c t a l c a r t l g w a s m p l t e d t h d
s m V t t h t h t l e t n a g g d k f r o m
c a t l a g m p l t t o t h d o s m t h e d t n t
r o d g f t h t p f t h e w h s p t t h m e o
l s b j t h l y e v d t i n a y c a n h c h the t e m p t
m a d t h l d t h t p f r w a d b y m s f c t l a g t u
l t h t g t s b n g f m h g h e r p o t h h n d g

Fg 7 G w h d t o t Th c h l d c e d b l o w
n t h n a b l d n g c u r d t h d p l a m t
w S o m m t h l a t t w o b e d t h a t n



Fig. 4 A



Fig. 24 B



Fig. 24 C



Fig. 24 D



Fig. 2

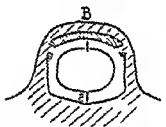
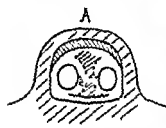


Fig. 25



Fig. 26 A



Fig. 26 B



Fig. 28 A



Fig. 28 B

was inclining to the left as shown. On the theory that this is due primarily to a growth distortion of the septum, he was referred to a rhinologist with the suggestion that the quadrate cartilage be entirely separated from its attachment to the maxilla and palate by the submucous removal of 1 centimeter or more of the cartilage throughout its entire extent. Although there was no visible correction at the end of several months' time, there was no further deformity and it is possible that the deformity may even disappear somewhat with growth.

Fig. 28 Trauma plus growth distortion. When this patient was 5 years old, she received a severe blow on the nose, but her parents observed no deformity until she was 10 or 12. At 24 years she presented the appearance shown in A. A front view shows little lateral deviation of the dorsal line which is usually quite marked in these cases of growth deformity following early injury. The left nasal passage had been practically occluded by the septal deviation. A submucous resection of this deviation had been done before the case was referred for improvement of the external contour. Sometime later, through an incision just inside of each nostril and crossing the skin at the anterior end of the columella, the nasal covering was elevated and freed from the underlying bony and cartilaginous frame throughout its whole extent. At the greatest prominence of the dorsal hump, just at the lower border of the bony arch, a cut was made into the quadrilateral cartilage, and

dorsally and then downward and forward liberating a small mass of cartilage which remained attached below by a huge pedicle of soft tissue. This flap of cartilage was turned down on its hinge and filled the triangular notch seen just above the tip in A. Then the remaining part of the cartilage bone hump was removed clearly with a five-eighths inch flat chisel, leaving the free edge of each cut nasal bone separated from the cut septum by the open anterior prolongation of the nasal fossa on each side. A narrow flat chisel was passed upward through the posterior part of each intra-estibular incision until it engaged the bony edge of the anterior nares below the nasal bone on each side. With one finger in constant touch with one corner of the chisel felt through the skin along the outside of the nose as a guide, the chisel was driven upward cutting at the depth of the valley between the nose and the maxilla. This bone cut usually starts below the nasal bone proper, but at any rate the bony side walls are loosened until the anterior cut border of each nasal bone can be made to fall medially into contact with the cut edge of the septum. The procedure does away with the truncate appearance that remains after simply chiseling off a hump. The cartilage flap was turned down and anchored by means of one split silk suture and the skin incision was closed with drains. B Shows the result 40 days after operation had been performed. Some swelling about the tip of the nose is still evident.



F 9 A



F 9 B



F 9 C



F 9 D



F 3 A



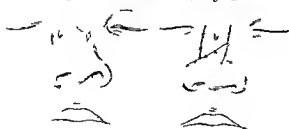
F 3 B



F 3 A



F 3 B



F 3 C

F 3 D

F 9 E l t m p l g t h d t t T m
 m h t l y b h l k d f t t n t t
 t t h l d d Th w t l c d
 p t f t h S f t h d m n t m p t w m d t
 h f t h h d p t m m m d t l y b m
 e c t f t h l t t Th t l l r n n was
 d e c t e d f d t m l b t w m d A n
 c h r a w a m d h w l p p m f m t t
 l w r n f t h l b t d n g h t n a s s a l b o t l f t m l
 t o t h Th t p t f t r y n d j t b l p h t
 w t h d t a l c h g (F 43) w b t t d b t
 t h l o f l e d f t h d e s d f f t d t t h d t t d
 d l b d o f t h t i f f l t p t m A t b

q t p t t h m g b l t t h h t f b o t h
 b o d t d w m e d f t e l t t h
 r n Th m t h l t w d s a l l w a t a b l h e d
 b y t h t u f t r i p f t l t l Th l t
 h w n B d D w p h t r a p h d s m t h l t
 F 3 E l t m p l g w t h d f m t y W h 6
 y r s f t h p t u t w l e d b y h r s I m m e d t
 d f m t y t m c h d l p e d l t I e s w t h
 m h a u l b y d t t d m p l t e d b
 n t h m p l t t y p f t c t m y b b y h u f t
 t p l t a p f b d k (F 3 C d D) Th
 a p n C w h d b y w t t c h d t l f t m l
 t t h S c t h e n a f m l l p l d t p p e l y
 t d b m p r a c t i c l y b l f t h t n t
 l t A t h m p t b m p
 t l t o d o t l t h b t r a c t Th
 t y p f p r a t p r m i t t e d w k t b d t
 t p d p t t w d h t l t t h h t
 d y B t l g d y f t p t
 F 3 T m g w t h d f m t y I t h u s y e l d
 b v t h l w p a t f t h d r s l l t a t p o d t
 t h b o d f t h q d r a t t l d t d t t f t
 d A t h l w h d f t h t l h e e b
 t r u t t h l f t t b l A f h t d t f t h b o v
 b d t l f t d d t w a r r t d t t a k l b o
 C c t n t e d b m m b l u z f t h l w e
 t n p t t f t h t l g l t h p h d m
 t t b d t t t l g Th p t m l d s a l
 p w t f e e f m f f f h f t h d t a
 b k a n d t h p w i t h t h d p t m w c h e d
 l t l t h t f m d l b y w l p t m t h d t r i g h t
 m l t t h W l f t n p l 6 d v s t d c y t
 c u f d p l m t f t m l



Fig 32 A

Fig 32 B



Fig 32 C

Fig 32 D



Fig 33 A

Fig 33 B



Fig 34 A

Fig 34 B

Fig 32. Congenital deformity plus growth distortion harelip. The whole primary fault in a harelip is a simple failure of a normal cleft to close at the natural time. From then on the growth of the surrounding tissues becomes increasingly distorted the amount being somewhat proportionate to the extent to which the cleft remains patent and the time elapsing before a proper adjustment and closure is made. In nearly all such no matter how slight the cleft there is a droop of the lower lateral nasal cartilage which gives form to the ala and a spreading and backward displacement of the nostril. In one sided clefts there is also a deviation of the whole nose to the opposite side with a deviation of septum and flattening of tip on cleft side.

Early forceful wiring of the maxilla to close the bony cleft does not itself correct the above nasal displacements described and in addition may be followed by a lack of forward progression of the anterior part of the upper jaw early loss and malrelation of the teeth also a droop of the tip of the nose and due to the maxillary retraction backward displacement of the upper lip and of the lower part of the nose. In this patient the deformities present at birth could have been corrected further distortion prevented much grief and many useless operations avoided if a simple proper adjustment had been made of the soft tissues of the lip and nostril at the original operation in early life.

The correction here shown was done when patient was 17

years of age and consisted in splitting the columella between the cartilages rotating the right nostril into proper position and opening and resuturing the lip. At a second operation the lips and cheeks were freed from the septum and the maxilla and this mass of soft tissues were advanced on the underlying bony and cartilaginous framework and sutured in this new position. After healing a prosthesis that carries cuspid and incisor teeth and which holds forward the upper lip was made by her dentist.

Fig 33. Congenital deformity plus growth distortion harelip. Case similar in origin and history to that shown in Figure 32. Besides the distortion of the nose lip and upper jaw this girl had also an abnormally long chin that was shortened by removal of part of the lower border of the bone to give a more pleasing balance to the face shown in B.

Fig 34. Congenital deformity double harelip. With the complete double harelip the distortions are different but still more pronounced the most striking feature being the forward displacement of the premaxilla and prolabium on the columella as in A. If the septum is cut across behind the displaced premaxilla and the latter forced backward at time of final closure of lip it is apt to drop in between instead of remaining in front of halves of maxilla. This results in a snubbed nose a retracted upper lip and a bony palate cleft difficult to close. Four correlated operations close the palate and lip rather satisfactorily as in B.



Fig 35 A



F 3 B



Fig 36 A



Fig 36 B



Fig 37 A



Fig 37 B



Fig 38 A d B



Fig 38 C



Fig 38 D

Fig 35 S f t t s e t t l p a d c h k f o m
f h d R l n g f o m l c a t t h s m h d l o t
m h f l p a d h k s a s h w n a n d h l g
t h t l p w s a l m o t b l t e t d R t o
t t e d f i t i n g t h e r e m a g c o n g f t h
t t l w l y m d e a n t e o N t t h l p
n d h l w e t d f m f l a p t k n f o m t h g h t
d f t h f o h d w t h t p d l t t b d t b y g m
d t n g t h t m p o l a t e y A f t t h h d l d
p l c e t h t p e d l w t d t t t m p l T h
t s e l f w m d e w i t h f l p t k n f o m t h l f t d f
t h f h d w t h t h p e d l t t h d t t h d f
t h g h t b w

Fig 36 P t h t c e t f o g b t a c e F g n s
s p p o t b t a c m p l t d w t h u n t h m y o t
p e s a t f t r y B f g a b d n y f t h m m y
t e n d t o s h i f t b t d d o t h c e f p l
m a y s e t p i s e c t i o n N e t e n y e p e
l y c o r r e t f a d p e e d b d g h d b e e a t t e m p t e d
b y t h e n s e t n f l p l a t e w h i c h f l w a h l o w n
t h o e o m n i t h p t t h e p h o b o w n A h d p a
t l l y c t t w a y t J d g f m t h a p p e o f A
t l l k l y t h t w h l p l c e t w a h t t e t e c h l t h a n
a t s t c l t O m g t h e p l a t t h e t w e e
f o d t b d p l y t d w t h c p p T h m a
t r n a l c i n g o f t h n w e d t o b u i l d f r w d t h e
l n g a d t h f l o w d e d b y t h c h e c k f l p T h e
i t s e l f w m a d e f o m f h d f l a p w h c h c o u t
o f c a c t y f m a t l w t h t t l t h e a l a g o d o w

t t h e p p l a c e A l n t f p o
t y o f t h l n g f p t h n o t l t h
s m l l b t t s s o e m b y w g o a l e d
t b t h t u r e e y b t h n g p d d o
n t m t n o n e h m T h d m d
t p w e e l t f i l l d t w i t h a c t l t

Fig 37 P s t h e t c t T h e f l l g n f
t h b d g d s i g h t p l t f t h e t p t h
c l l e d f o m t h l f t h e q d t e c
t i l g f m a c t e p n f t T h c e
t n w d w t h p f t a l c t l g e
t d t h h a w t h a d p l l e t o
t h b o d e f t h n o t l d t h u g h w h i c h t h e
t a a l c o g w d i c t e d f m t h
n d l y g h o a d t i l g F m l g
u n t s t i l p r o t h e t l c t l a g e h t h
g t t i t o f b e g a l y m l d d a d f
m a g p e m e t l y f t t h l f
s u f f i c i e n t p e n h o d m h b t e d t
s u e i t s n t n t I t i n c l u d t h l a k d i y
i f p r o p e r l y h d l d n u f t f i l d b e c m e s
m u d d y i n f e c t d T w g t b j e c t s t h a t

c n b e b g h t a g a t t t h t t h p t t h m
I f s h o u l d f u r n s h t d l t b l t d e c y
l a t e r t o c l u p a d b e c o m d t t d S m t l c t
l g e s y e l l w h a d s o m w h t t r a l t d t h k d
h a s l i t t l e d e c y t c l c e p t w h m p t l y
t h a s t r p l f t w i t h p h o n d m o n l y
T h e n i t w l l b e d w t h t c o n c a t v t w d t h p h o
d u m t h c a n b e c t l l e d b y t l y c t t g h
p e c h o d r m a d d t h m m e d t l y d l y g l y r f
c a t l a g e a t h o t a n t e r l O t h e t l g p q l y
w h i t e a d t h h a s a m b g e n t e t d n c y t c l W i t h
s c h a f t e r t h e i n s e r t s t a t o t h e p o p r s h a p e i t u s t s e
e s e l y c u t a d d e e p l y a d t a s h r t n r v a l s m p o s
b l e w t h t s b r e a k g w h i l e b e g s e t d E l u m
i n f b l d c l o t s a d m t e n a c i f p f t h
g e t e s t h l p t o s u e c i n h e a l (s e F g 6 9) I t
q u a l l y i m p t a n t t h a e t h e c a r t l g h l t h d e e d
p s t d t i n s u e t h u s t s f i d p l b y h h
u t s t h p t e t t h t h t h e c g d t h l g f
t h n l l d t h t a d m t m e t s i x
t h c a t l a g t s l f

Fig 38 T m w t h d p l m t A h w t h a t t h
b d g h h p h d h c k m o n t h e l f t t h
h t d d h l b d p l d s l i g h t l y t h g h t
I t t h t h t h t l g e t h a s t b c t r d
l y T h t l g h d b e c t e c t l y s p o
b l t o t h p t t b t w h e n d b t s m l l w
m y b e m d f l i g h t l y g e a t e i t l b u l k d l g h t
I f t h e t l l o a n c e h s t b t o g e t d t h



Fig. 39 A

Fig. 39 B

tila e has been properly placed it can be conveniently carved to a more desirable outline after it has healed firmly in place as was done in this case. This however requires that the dorsal covering be again raised. Where the depression is symmetrical as in Figure 37 the pattern is cut from two pieces of flat sheet lead one for a longitudinal and one for a transverse section but in the above a three dimension lead pattern was cast in an oven-dried plaster mold made from a clay model built up on the cast and removed without distortion. The bulge of the nasal bones to the right still shows a little more noticeable in the photograph than in the life. Had the lateral displacement been any more marked it would have been advisable to have carved it with a chisel before implanting the cartilage. This is an extra step to be avoided where unnecessary.

Fig. 39 Normal but displeasing. In these days of candor and open discussion public education etc. the flat nasal bridge may be resented by its host not only for its asymmetry but from a deeper possible significance of an inherited or acquired iustic causative factor. In A the depression is a natural one and to the trained clinician there is no suggestion of iustic origin. However many seek a correction of a naturally somewhat depressed nasal bridge and for that purpose we use a costal cartilage implant that avoids giving any suggestion of a dorsal convexity (Figure 39 B).

Fig. 40 Prosthetic inserts. The tendency of costal cartilage to curl is increased if a bending strain is placed upon it. One case came under observation in which such a pillar of costal cartilage had been implanted into the septum just above the columella which was holding up the tip a number of months later. Ordinarily this might have been considered a good result but the subject was a movie actress and was seeking further correction on account of the resulting extra width deviation to one side and downward displacement of the columella and its unnatural pillar like appearance.

One can more or less successfully use an implanted mass

any pathological process present and each of the anatomical components separately also the facial balance and the patient's mental reaction and in addition will study and experiment upon plaster of Paris and plastic reproductions of the face he will usually be able to make a working diagnosis and prognosis and where indicated a plan of correction (Fig. 3). The general plan of correction should always be worked out before decision



Fig. 40 A

Fig. 40 B

to bring forward a depressed nasal tip if there is a sufficient resistant foundation of depressed dorsum upon which to rest the longer base of the lever. But a thin long strip is apt to bend and if any major part of the anterior lower portion of the quadrate cartilage is missing a short implant is more apt to be drawn backward than to hold the tip forward. It has been advocated to put a supporting pillar into the septum along the upper border of the columella but this we do not use because of the belief that the width of the piece required would impinge upon the breathing space and because of the danger of its bending or being extruded under strain. A Shows outline of a nose in which following a pus infection of the quadrate cartilage there was sufficient loss of the lower part of the cartilage to permit of a retraction of the tip with lessened air way. Some one had attempted to correct this by putting in a dorsal mass of cartilage supported by a mortised pillar of cartilage in the columella. As the supporting pillar gradually gave way the tip dropped and the upper end of the dorsal piece tilted forward as can be seen. There being no upper fixation of the insert it is probable that there never was enough downward thrust to give proper length to the dorsum. Relief was again sought not only on account of appearance but because the rhinologist who referred the patient attributed headaches to the partial obstruction to the free entrance of air into the vestibule. At the operation both pieces of the original insert were removed and a piece of a rib cartilage graft was inserted in such a way that the upper end of the graft could ossify to the nasal bones to make a rigid support to the tip. The lower end of the graft was of cartilage. The tip with its contained part of the graft was held forward with an intranasal splint fixed to the upper teeth pending firm union with the nasal bones above (see Figure 43). In this particular case in spite of a stormy convalescence due to an autogenous infection of the graft from a pimple 13 days after its insertion and subsequent partial sequestration the remaining part healed in place. See Figure 40 B taken 9 weeks after the insertion of the graft.

to operate is made (see legend under Fig. 38). This will save time and missteps will facilitate the work and improve the result (Fig. 4).

Types presented. The conditions that are presented for correction may be roughly classified as coming under the headings of

A Normal noses with average facial symmetry but with which the patient is not satisfied. As a

(Text continued on p. 811)



Fig 4 A

Fig 4 B

Fig 4 A

Fig 4 B

Fig 4 A

Fig 4 B

F 4 \ rmal b t l a c k h a r m n y f i e t h f
h d d p p l p a f l s s m l d b t a t f
h m y w t h t h e l a g b o l d b n T h e p t c h a d
h m d f c u d t h e t h e f t h t a s t h f
t u t h e h a g e d I n t h q u i n t e s s t u
c a l l t h t h l a t o o f t h e n t l d t h w i d t h f
t h b e e c a m f i g e d b y t h e d r a l c n t y r
k d t h e l l b c m s i n k i n g l y d t s o
t h h m p r e m d T h e f o o n w i l l e t h e k f
t h l d d p p o t m n t f w b e d e d t h e b
l s o s h t e d d t h b d e m d r o w l t t h c a m
p t o I n t h e s p o e d l y q u i t h n
t r i l a p t t h r y n w d t h e p p l p d w n p
w a d n t l n f t t h e l t s s h t e t h a n s a b i l i t y
m e t t m p t s f r e e d n p t w i l l c a c o l l p s f
t h a l w i t h p t a l o b t r u c t n N o t n B t h a t w i t h t h
n n d h r t g o f t h t p t h e t r i l h a e b e c m e
m e d d d t h u p p l p h d p p d d w n w a d
l t h t h r t h p m t t h i s h s b e c m e l s t
b l

F 4 N o m l b r d p l I t h c a b o t h t h e
t v f t h d r s m d t h d p w e b j e c t e d t
b t d e f p n m e t l h m d n g l t s m l d s
s m d t w a r r a t h d t h t h l g t h a d
h g w e t h m j f a c t n d t h a t r g f a w l d
r u l t i m o e c t t h e s d l g t h l g h t d r a l
c t y t m H h d l s o p l l b t r u c t d
t a d f l e c t f t h l w e b o r d f t h q d r t e c t l g
t o t h r i g h t t b l W f t t e m p t d b t c o r r e c t
b y g p t h k n g d u b m u s l y e m g
a g d u d t r l f m t h l w e n d f t h e q d t
c a t l w h c h l d e d t h b t r u c t g p o r t w t h n t h
r i g h t n t l W e d w l s o e m e d f r o m t h p p
l a t r a l c a t l g e s d t h d g l e d w i t h p l t s l k A f t
h l n h d t k p l t h l t w a s t l l t t f
t r y d t d s t p t h c o l u m l l w a s n w d
d t r e d a n d t r a g h t l g t t h u n d b o
d T h g h t p t e p e d h m l f t t h c t r y
e s t i l l e c t t a t h t h w a p e r f e c t l y t s i f e d w i t h
t h e r l t

Fig 4 2 N m l b t d p l g T h h t y p n e
o f m w h a t a m p l e p o t w a w s h e d p o r y
a t t r a t p e t t y l a d y f t y p n d e
l d b l a m e h e f d e s n h T h a a c c m
p l b e d b y c h l f t h s o f b d c t i l

f t r a g f t h e n s a l o e n b y h u e l n g l o o s e t h
m g p t f t h e b r i d g e a c h d d b y d r i t n
t h l b r a t e d n s a l b o s m e s l l y n t l b o t h t h d r s m
a n d t h e b w f p l i n d t h \ t t h a t t h d r o p
p b k f t h f t t i s f t h h s a l l w e d t h
u p p l p t c o m n c o t t w i t h t h l w e w i t h t r a
l t h m r t h e p r e f t h m t h h a s b e m
p d

F 4 3 T m a w i t h d p l a c e m t f i a t d t a l
p l t h o y d t t h e t h r e s l t f m d i t r e d
g w i t h m l u n s t h a t q r e s e c t d r p l c e m t
w i l l b o q e f i n t n t p o t f t 4 w e e k
I f t h e p l c d b n d e q t b h l d f r a w d o f r
w d a d t t h m d l e t h i c a b t h d e t h a a d
j u t a b l e p l t a t t c h d t d t a l p e c m n e t t e d
t t h A S h o w s g r w i t h d i t r o n a d l s o t h e s e f a
e e n t e s n o t h e n h t l r y m l s a b h s t h p l t
p l c w h e t w a m t e d f r m 4 w k C
S h w t h l t

F 4 4 T r a m t h d i p l c e m t f i t d t a l
w n L a t e r a l d i p l m t f e e l y c a b e p h e d
t t h m d l a d f t h e s e p t m h a t h e r b r o k t
w i l l l i k l y e t t h e b n d t t a l p o t o n w h t h
m p t t s r l e d I f t h t e d y f o t h d i
p l a c m t t c u t b e f f e c t l l y f i e d i n o f t w
w a y s W h t h e b a c k w a r d p l a m t t h b n d
c a n b e f i e d b y a d w a w h c h g e s t h l w e d
f t h b o y b n d s d r u t h r o t h e s t b l
d t a h r e s t h f t s s s t b n e c h r d t m l a
t o t h n t h o p p o t e d e l i t h e c t t y f i t b n d
t m h d m a e d t h n d j t a b l b f i e d t
p p e d t a l p l a n t d T h l a t t r m o r e c o m p l
c a t e d m t h d b t h s a w d h l d o f f l n (F 4 3)
I c a w h h a l t t m y b e n e c e s s a r y t
m b u l z e t h b d w t h c h l b f i t b
p l e d (T h e t a g r m a y g g t h b o t h r o g h
s m a l l d e f i l h l w h i c h r m a d t h r o h a m l l s t
n l o)

F 4 5 T u m w i t h d i p l a c m t f i t o d t a l
w n I t h c e c t n f l d i p l e m t f l
s t a n d g w h t h d t t t g r o w t h r m a l n a t
m y b e c c a r y f e e t l w r b o d f t h e s e p t m
f r o m t h m a l l r d t o s h i f t t i t e a l l y e w a y t h
t h I t c a n b c o e t l y h l d n p l c h w n t h
f i g u



Fig 43 A



Fig 43 B



Fig 43 C

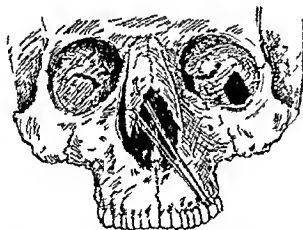


Fig 44

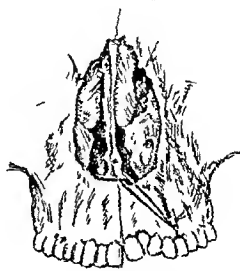


Fig 45

class these constitute a plentiful and facile source of business or a nuisance according to the practitioner's viewpoint and ambitions (Figs 5, 6 and 7). Unless the attention of these patients is definitely concentrated upon some easily changed element such as a simple hump or depression it is better for the well intentioned surgeon and if he will accept the advice also better for the patient that the desired correction not be attempted (Figs 8 and 9).

B. Noses normal or nearly so that from trauma or some other cause are sufficiently out of harmony to warrant a rational surgical modification. The nose may be too large (Fig 10) too long (see Fig 42) too short (Fig 11) have a dorsal hump (see Fig 41) depression (see Fig 6) or some other non pleasing character.

With these can be grouped as far as correction is concerned all the congenital oddities such as absence of the entire nose (Fig 12) and of half of

the nose (Figs 13 and 14) bifid nose (Figs 15, 16 and 17) lack of forward progression of the nose (Figs 18 and 19) and actual retraction of the maxillary foundation (Figs 20, 1 and 2).

These are to be considered proper subjects for surgery according to the impression they make on the patient, his general condition and the ease with which the correction can be accomplished, the first essential being that the patient is seriously and deeply desirous to have the correction made.

C. Acute injuries without loss of tissue but possibly extensive fractures and maybe lateral or backward displacement tears etc (Fig 24). In these if seen early all tears in the lining should be accurately sutured, impactions pried loose, broken or misplaced cartilages and bones replaced and properly fixed in position and a free air way insured. The correction should be made as soon

(Text continued on p 815)



F 46 A F 46 B



F 47 A F 47 B

F 46 Tra ma with d plac m nt A bl d ect d b lw d d maybe pw dh a crumpling ff ct that both flatte s d hort n If this s n tammed tly ected it d fficult to sto the l gth lat A Sh wa o that ec ed chan jry dw nhy s we k l te Th asal bone we th n p d f ce f lly f w d to t op the p t lly u ted fract h e d held forwa d with a d f table h ph t t ta bed t the eth Th had h en tear n th l n g f th ht thule which th sc rn h d dra n th bord f th st l pwa d n th t sd Th sw n ected hy V l p t n th l n f the s thule

F 47 T m with d plac m nt A Show the p o fil f g r who f m hl wh tw n th ye an a t d t b d th asal b es d e n betw n the na l p of th ma ll d th sept m crumpled ch gwh th dh n h gh q l eno t th f rm h wn E d tly h gen l c d t n mm d tly afte the ac c d t d d t p e mut of th se bo h g pred f rward d h l d n the p p e sh pe and po t d wh n e n late th y w e t firmly fied h m ed n th orig nal f ct pl e s C rrect n w s attempted hy s ert g h l ach stn l d c t g the bo y no e free t d p plane po bl and c l d g with t som f the bo y f f of th f tal Th m was p d fa f rw d spo bl d h l d with plnt Late ft new bo y f t b l d cured t lag w ted t bri th brid e st l f th forw d

F 48 T m with d plac m nt A hl w on th brnd wh b f t d p d s th l h n s may l thru t t d th sal p s es of the m lla and th



F 48 A

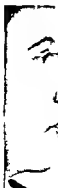


F 48 B

l crymal bo es th s den th d ta c h t th ternal c th Th s d pl me t f the c th b ry ot bl with l t ely l t l flatt g f th b d e If seen ly t l kely th t s th l bo c e p n d f w d the h s t the ba ld be qu ed m ally the w th th mb d finge w th to cep p d t h th o r h i m lo f th lac ymal s Web en s of th lv b t h lat m de th rectio th ough no ch des mul t that f cm l f th l crym l ac W rk b k b t we th d p no cum th fo m s u ded hy ts l t d t pu hed tw d t e p c the bo y ma This m d s flic tly: all d ct to ll w th c that b h ough t the n m l p t n d also t na w the n sal h dg p p rly l d g th the int m l p a b l l g am t i cut d t bo y tta hm tis em ed b th dorsal bo de f the bridge p ried Th t m al ta sal l g me t pl d b v l p f No 004 d y catgut th t ent d m ge w th ch n c th th t and p sung fro to f th r ymal cs nd t ght though th s al c v t d l the pt m th kn t be n g t d t a th As the knot d w nt ght the c th p l l d n w d nd will bec m f d the by th s b fo eth catgut h s bec me b o b ed B Sh w th ect n oht n d by th s m th d

Fig 49 S ft t estorat n t p a d la from rm fl p A Sh ws y g w om who lo t h t p of th o d m d a half f chal f m n d t The p wh ch w m d f man ar m f p p ed q t s t f ctory p t f the f t that t g w lo g fine h i all r t Th e w e e p r m ne tly d t y d w th d m b t h d w ass f u t to e a l ght h r i k g f th b sh n B Rad t n f d p l t w s nly n ce p t on l e a nd h en l d s t p fectly t s f ctory

F 5 S ft t s r t t n t p f r m m flap A l s f th t p th t t e d s t th t r l l f t



F 49 A F 49 B



F 5 A



F 5 B



F 5 C



F 5 D



Fig 51 A

Fig 51 B



Fig 52 A

Fig 52 B

ration of lining and covering as well as the nostril border. This requires a flap that is not only large enough to restore the tissue actually lost but to obtain a blood supply in its new location. In this case the flap was taken from the arm.

Fig 51. Soft tissue restoration nose and upper lip from chest and forehead flaps. In this case it was necessary to remove practically the whole nose and the full thickness of the lip except the vermilion border because of an infiltrating paraffinoma. This was done with a cautery and while waiting for the burnt bone to be thrown off and the wounds to clean up one flap was prepared on the forehead to make both lining and covering of the upper lip and one on the chest for the nose. A Shows the step at which the gross restoration of the lip had been made and the defect on forehead recently grafted. B Shows the finished case with final adjustment of the lip and completion of nose with cartilage implant. The arm or chest flap is thicker and softer than one taken from the forehead is apt to be of an off color and not capable of same amount of molding.

Fig 52. Soft tissue restoration ala by a cheek flap. Following the removal of a small growth and repair of the defect the patient was seen with this condition. There is a normal lateral overhang of the ala the loss of which is very noticeable even though the wall of the nostril is intact. In this case a flap was turned from the fullness of the cheek contiguous to the upper lip base above and apex just above the corner of the mouth. The borders of this cheek defect were sutured together leaving a temporary drawn up of the lip and a scar that is so inconspicuous that it does not show in the photograph.

Fig 53. Soft tissue restoration vestibular wall from cheek flap. This 13 year old boy had a piece lost from the nasal wall and the lip injured by the bite of a dog 6 months previously. Repair was made from a cheek flap taken from just external to the nose base toward the inner canthus and pointing toward the corner of the mouth. At the same

time the flap was raised the lip scar was opened and re-sutured the ala scar was also excised up to base of the flap. The cheek defect was sutured closed which drew remaining part of ala outward this in turn enlarged nasal defect sufficiently to receive flap. This was sutured in place its end being doubled under to form alar border and lining of vestibule. B Result 3 years after the operation.

Fig 54. Soft tissue restoration surfaced with free skin graft. Where the lips and cheeks are also burned restoration of these by surface grafts will contribute to the nasal improvement. In this case besides the split skin grafts that corrected the ectropion of the lips the drawn up tip of the nose was released by a diamond shaped full thickness graft put in across the dorsum. The irregular scar on the side of the face and under the chin could be further improved by more extensive surface grafting.

Fig 55. Soft tissue restoration lining from neighboring flap and covering from skin graft. In this patient the plan used in Figure 52 was somewhat reversed. The lining was made from a flap of the external surface bordering the defect which was turned in on a broad pedicle and the external defect which then was of the size of the original defect plus the area of the turned in lining flap was immediately filled with a full thickness skin graft taken from behind the ear. This allowed the operation to be completed at one step. The area from which the skin graft was taken was completely hidden by suturing the borders of this defect in the crease where the ear joins the skull.



Fig 53 A

Fig 53 B



Fig 54 A

Fig 54 B



Fig 55 A and B



Fi 56 A



F 56 B

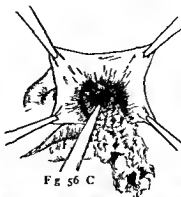


Fig 56 C



F 56 D



Fig 57 A



Fig 57 B



F 57 C



Fig 57 D

Fig 56 S ft t t at l by a f k
g ft k k g ft f l ss th f l th kne h a
ry d bnt t d yt tr t dw the ef d t
them pla h llw c t b m def
th I t l fndt th c t b l l g that
b tru t b th g p c th m tsat f t y t at o
m d by f p l t k g ft p t asp g

ga th t p d the no trit b t w t m l
iz w th t i d pes Th graft b g than
do n t f t l f d d to th b trut Som t m thi
m t b p tede en mo th
l n whch rag th l by hifun
flp f k n m sa d wh h b maun
th y ca he p the l t d by g th p k g with
spl t g aft No attempt m d t f m th g l t c th
s c f th d f c t a d p f k t l t he ro
su d l k e th n g f M k l c z p c k

F 57 Soft t t to l g f m a m f p
Wh the cat lag well the l g mu g
tho gh the k n c ring tact the ped cl f p
th than f esk g ft qu d I th f p
t k f om th m d ha g bee m d th po
bl wa l t by c t t g th col m lla t rsely t
h k f th l p Lat afte th ped cl f th flap t
d d j t d th l mella was r t d p lce Th
t p wa d b t l ttle to m ch d d t by set
i g pec f t l c a t l g

F 58 S ft t e to t p t l l g a d c
g f m f h d f p The bo p t ompl t
lo g l g ds p p o t t e o r p r t f
then s e w th h l f the wo d d c t r a t
that d tort th m g p t Th ect nm t t
only stor th l b t l b n g th d p l d p t t
the p o p e r p o t Th form wa do by tw ped l
fl p i m th f h d to f fuch trp of tal
c t l g e a m p l t d b i b g th m d w At th
t m th e p l y p p a d f l p w b o b t w d
th all b d g w m ed th t th l d



Fig 58 A



F 58 B



Fig 59 A



Fig 59 B



Fig 59 C

Fig 59 D



Fig 60 A



Fig 60 B

tip could be brought down to the proper level as shown in B. Though in this case the costal cartilage that gives prominence to the dorsum was implanted into the lining flap before the latter was brought down it is usually a better and safer practice to restore the lining and covering completely to allow these to heal in for some months before inserting the cartilage. This however adds an extra step to the operation (see Figure 36).

Fig 59 Soft tissue restoration tip from forehead flap. Shows a boy who lost the tip of the nose from the bite of a horse. In this as in the preceding case the flap had to be formed so as to replace the lost lining as well as the alar border. The pictures B and D were taken 4 weeks after the operation. The swelling, the lines of union and the skin grafts on the forehead are still quite evident.

Fig 6 Soft tissue restoration of columella tip and part of lining and covering from forehead flap. In this patient the loss due to an ulceration which occurred in the growing period included the columella tip of the nose and the external surface was so shortened that lengthening was all necessary. This was done by a forehead flap that was first let in through a transverse incision below the bony bridge to line the vestibule and form the tip and columella and at subsequent steps the flap was cut and the pedicle used to lengthen the external surface. This let the upturned ala drop down to their proper level (see Figure 50).

Fig 61 Soft tissue restoration ala restored from forehead flap. A Shows a boy 20 years old who from the accidental discharge of a shotgun at rather close range 14 months previously lost the middle part of the lower jaw most of the right side of the lower lip and chin quite a bit of the right side of the upper lip and right ala of the nose the anterior part of the upper jaw and corresponding part of the floor of the nose. While doing other repairs a flap was raised from the right side of the forehead with its base above the inner end of the left orbit. Six weeks later this was tunneled down and with its distal end doubled over it self to make a lower border and lining for the new part of



Fig 61 A

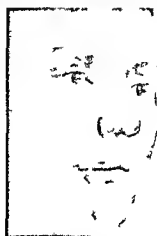


Fig 61 B

the vestibular wall this was trimmed and sutured into the defect after the distorted scar from the ala was removed thus restoring the original size of the defect and allowing the remaining part of the ala and that side of the tip to be brought to their natural positions. At subsequent steps the base was cut across and adjusted the pedicle uncurred and implanted back on the forehead and the remaining granulating area covered with a split skin graft. The free border of the new part of the ala was thinned out by an intramural excision. B Shows his appearance 21 months after A was taken. During this period in ten major or minor steps the lower jaw was first united in the midline later cut obliquely in the mental region spread laterally and again united to restore proper width to the arch and occlusion to the teeth. The lip were worked toward each other and over to the right. The left cheek was advanced and the upper and lower labial fornicies were restored with split skin grafts implanted upon a wax form.

All of this would fall short of its present appearance and utility were it not for a set of ingenious dentures that was patiently and painstakingly worked out by Dr J A Brown to whom and to other dentists we are indebted for the final satisfactory outcome of a great many of our cases.

Though his appearance is no longer conspicuous patient can mask it and he appreciates what has been accomplished in common with a great many others of his kind he is rather insistent on having still further work done.

Outside of the unnecessary depth of the skin scar we believe that all has been done that good judgment calls for.



Fig 66 A Fig 66 B Fig 67 A Fig 67 B

of not only the columella but of some space on the under surface of the tip

Fig 6 Soft tissue restoration ala by a hand flap In this case the covering of the whole side of the face had been destroyed with radium in the treatment of a cutaneous angioma Most of the restoration including the side of the nose was made from a chest flap but the overhang of the ala was still missing and this latter was obtained from a flap taken from the inner side of the arm

Fig 66 Air friction the overhanging tip In the above case the nostrils were large and the vestibule ample yet the patient was distinctly conscious of a respiratory effort that was relieved by raising of the tip of the nose He was referred by a rhinologist to have the condition corrected This was relieved by removing a wedge shaped section from just within each vestibule that included lining and a section of the lower lateral cartilage and a full thickness wedge from between the columella and the septum The bases of the wedges removed all joined each other inside of the tip Suturing the borders of the defects after under



Fig 68 A

Fig 68 B

raising the skin of the tip upward gave the result shown in B There is always some tendency for the tip to slump down a little and some overcorrection is advisable

Fig 67 Normal but displeasing From the history it is probable that the condition shown in A was mostly due to previous attempts to correct a facial deformity The condition in B was obtained by a costal cartilage implant One does not at all ways obtain quite so pleasing a result Note that there is a little suggestion of the objectionable rounding of the nasal tip often evidenced after an implantation

Fig 68 Soft tissue repair with dermal flap This man had suffered a puncture wound of the skull at the base of the nose three years previously leaving the depression shown This could have been filled with a bit of cartilage and the skin borders approximated and sutured It was considered preferable to raise a flap of de-epithelialized derma with its subcutaneous tissue corresponding in size to the area of the depression and switching it downward on a pedicle attached to the left The skin and forehead tissue bordering the original defect and also the contour defect resulting from the raising of the dermal flap was undermined and approximated by one continuous suture line with the result shown in B

and as thorough as possible and not to do so whenever possible is a serious injustice to the patient (see Figs 24 25 and 26)

D Obscure or questionable injury in infants or young children in which there is swelling of the bridge and possibly a history of nose bleed but no evidence of a fracture or of cartilage displacement (Fig 27) Often these are followed by increasing and ultimately severe deformity (Figs 28 29 30 and 31) It is thought that the condition here is primarily due to some injury of or compression on the quadrilateral cartilage with subsequent banding and intense hardening of this structure which is accompanied by a secondary distortion of the bony and soft tissues In view of the severity which such changes may reach it is good routine practice if consulted early to give an anesthetic and forcefully pry upward on the nasal bones from within on the chance of correcting some slight displacement At least this would eliminate a rather common subsequent imputation of negligence If seen after the aberrant growth of the septum has become evident by external distortion it is equally good practice to have a sympathetic and competent rhinologist remove

submucously the lower third of the cartilaginous septum This tends to destroy the foothold that appears to be an essential factor in producing the increasing bony and cartilaginous distortion and should be done as soon as a definite deformity is detected the standard dictum in regard to septal resection in children being disregarded (see Fig 7)

E Another common instance of growth distortion is the increasing lateral displacement and alar droop which is more or less marked in cases of harelip where the proper relation of the base of the columella to the labial attachment of the ala is not restored at an early period of life (Figs 32 33 and 34)

F Actual loss of part or all of the nose and possibly part of its foundation either from accident injury or disease the remaining parts possibly having become displaced by scar or abnormal bony growth (Fig 35) In the correction each individual damaged or lacking component anatomical element lining covering and supporting framework must be restored but first any active disease or infection must be eliminated and as a preliminary operative step distorted tissues must be liberated and replaced



Fig 69 A



Fig 69 B



Fig 69 C

Fig 69 E The lip e f p l t d t h n t r o l
f well g Th mple met l p l t m a d f t h e l y
b n t t c p p o h t l a d h w n s d f r q t y
f t h p p t f t n e d n a l p o c e f u p t f
c a t i l g t r n p l a n t a n d f p p l i c a t i o n f p u t t h e
d l e n w h n t h s b n a d f o t h e p o c
d s Th metal s c u t t o a s t a n d m d l a d t h n
t m m e d f o d d l u s a d f i t t e d e c u t l y Th
s m a l l w g o n t h e f o h e d h l d s t h s p l t u p Th l g e
w g f t h p l a t p p l e t h p e u r e d h l d p l a
b y g e t t o n f t h c h k n t h e d h s s t r i p
Th s e m y b e w n a t h e r c m f r a b l y (w i t h f e q u e n t
h n g e) f o l g j w e k s F i m m d a t c n t o f f

p o t p a t s w l l i n g l g e t d w i t h m
p g p e r e u d l o r c o m b n t w i t h t h
t y p e f p l t
Th e s t e n d c y f t h p l i t t p u h t p f t h
n s d w w d I c n w h c h t h e e g o f t h n
h a b e e e d f m t h u d l y n c a t i l w h e t h
c t l a g a b o k n t h t d n c y m a i g t b e c o r t e d
n t a n c t u l y Th s c b p a n t e d b y p t t g a n
o w l p o f a d h e p l s t e f o m t h f o h e d d o w
p a l l t o a d i n t a t w t h d f t h n e o d
t h e t p a n d p t h t h d e t o t h e f o h e a d w i t h f i c t
t e n n t o h l d t h t p p w a d Th s p l t s a p p l d o
t h

Incisions When necessary external incisions may be made on any part of the nose because if properly sutured and if there is not abnormal tension the scar will ordinarily become unnoticeable. For implantations molding of the bony bridge and bone excisions the incisions are made parallel to and just within the nostril border but for better access the intravestibular incisions can conveniently be combined with one made externally across the columella just under the tip. This places it in a rather invisible site and allows the skin covering to be dissected upward to display all structures below the middle part of the bony bridge. Unless the vibrissæ are exceptionally thick or long it is possible and we have concluded advantageous to disregard them and make the intravestibular part of the incision between the hair and the border of the nostril.

Saddle nose For the saddle nose various inert substances are advocated for implantation under the skin to fill out the depression. These include rubber gutta percha celluloid ivory metal etc (see Figs 63 36 and 51) as well as autogenous live grafts of bone or cartilage (Figs 37 38 and 39). We prefer the latter but have used ivory when cartilage transplant was contra indicated and a rib costal cartilage graft when rigidity was desired to support the tip (Fig 40).

The humped or aquiline nose is more apt to be

too long than short and to have a drooping tip. Dorsal humps may be removed with a saw chisel or a rasp. Use of a saw for this purpose requires the highest quality of skill. The field for the rasp is limited and the results are apt to fall short of being satisfactory. With a chisel one may remove as much offending bone as desired in one piece or bit by bit but great care should be taken not to leave bone fragments or rasps behind as they may lead subsequently to deforming thickening. A sharp lateral biting forceps that will cut on only one side and is slim enough to work through the intranasal incision is very convenient for removing pieces from the dorsal border of the quadrate cartilage and slight irregularities from the chiseled bone. At this same operation the nose can be shortened and the droop corrected by removing wedge shaped sections from the columella and from each lower lateral cartilage and contiguous vestibular lining. Sometimes the full thickness of the wall must be included. The truncate appearance that remains after a marked dorsal hump is removed is corrected by shifting the nasal bony supports inward after they are chiseled free from their maxillary attachments. By cutting the lower lateral cartilages and molding the tip some more or less pleasing compromise between what is desired and what constitutes good surgery can usually be obtained.

here. All of the above operative plans might be included under a heading of intramural operations and are done through concealed incisions (Figs 41 and 4 and 4 1/2).

Fractures and malunions. In displaced recent fractures little is required but possibly forceful release of the impaction with replacement and splinting. Displacement in any direction can be controlled by an adjustable splint attached to the teeth (Fig 43), but a lateral deviation may be anchored by an interstitial wire attached above to the mobilized nasal bridge and below to a molar tooth of the opposite side (Figs 44 and 45). Through and through wiring penetrating the fracture lines across the base of the nose fastened over lateral lead plates on the two external sides of the nose might satisfactorily restore the prominence of a sprawled out nasal bridge but intra nasal packing is rarely sufficient. Fixation may be gotten with plaster of Paris head casings but in these there is always considerable movement. A nose cannot be crushed in without either tearing or crumpling the quadrilateral septal cartilages and this should be immediately straightened to its natural position and all gaping tears in the lining should be repaired when the bridge is elevated. The replaced septum gives support to the bridge but if it is left crumpled or torn it constitutes a permanent nasal obstruction (see Fig 24). For malunions or growth deformities the chisel may have to be used freely (Figs 46 47 and 48).

Soft tissue losses. For replacing a damaged or lost nasal covering there is nothing as satisfactory as a skin covered flap of forehead tissue (see Figs 4 and 35) but perforce we have used pedicle skin flaps from the arm (Figs 49 and 50) and from the chest (Fig 51 see Fig 65). For relatively small losses from the nasal covering a pedicle flap may be taken from the fold of skin and subcutaneous tissue that runs alongside of the nose downward and outward on the cheek (Figs 52 and 53). This is more pronounced and more usable in middle age than in youth. Surface skin defects can be repaired by free full thickness skin grafts taken preferably from behind the ear (Fig 54). Large areas of loss especially if these include the subcutaneous tissue are better restored by a forehead flap that has seasoned long enough to allow it to be sufficiently thinned without risking blood supply (see Fig 63). One can sometimes line a small full thickness defect by a pedicle skin flap raised immediately adjacent to the defect. The raw surface which results after turning these lining flaps is double the size of the original defect and is covered with one free skin graft (Fig 55). Free split skin grafts are appropriate to restore the nasal

lining in areas in which the supporting framework is intact (Fig 56) but for restoration where the lateral cartilages are damaged or part of the full thickness of the nasal wall is missing we prefer skin carried in on a pedicle flap because it does not shrink (Figs 57 58 59 60 61 62 and 63).

A missing columella can be restored by a flap from the lip or cheek or forehead (see Fig 60) but we usually resort to a hand or wrist pedicle flap to get more tissue and avoid a noticeable scar (Figs 64 and 65).

The nose like a house requires a foundation upon which to rest and when the foundation is lacking or deficient, it must be restored or supplemented (see Figs 3 and 35).

The air way. The nose is an organ of respiration therefore, free nasal breathing should be insured. Raising the drooping tip or lengthening the columella of an otherwise normal nose will often facilitate the intake (Fig 66). A nose with ample nostrils that has its tip tilted upward may take in air so freely as to cause excessive drying of the lining. In some instances this can be advantageously lowered with a dorsal insert of cartilage (Fig 67).

Abnormally large nostrils can be reduced by removing sections through the full thickness of skin cartilage and lining. Losses of skin or subcutaneous tissue about the upper part of the bridge can be replaced by a skin covered pedicle flap or a dermal flap from the forehead (Fig 68).

The over effort to draw in air through small or obstructed nostrils more often through nostrils in which the air stream is impeded by an overhanging tip may cause collapse in the upper part of the alar which further increases the obstruction.

The splinting of the collapsing wall by the intramural implantation of cartilage shavings has been advocated but we have confined our efforts to the attempt to do away with the cause of the obstruction.

Postoperative hemorrhage. It is not practical to tie cut vessels in doing intramural nasal operations usually pressure for a little while will control bleeding but occasionally in spite of ordinary precautions the thickness of the wall will balloon up with clot. For this reason cartilage grafts are sutured in place and small drainage tubes are inserted through stab slits in the lining in such a way as not to touch the implants and external to the dressings a molded thin tin or copper splint is held in contact with the dorsum with light packing in the vestibule (Fig 60).

Sutures may be left in place much longer than on any other part of the face because the nasal skin does not scar easily.

HYDRORRHŒA GRAVIDARUM

JAMES R. GOODALL, OBE, BA, MD

Cl. in 1P, fesso, 1 Gyn, 1 gy

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HYDRORRHŒA gravidarum is a clinical entity that is seldom understood and more rarely diagnosed. It consists in a slow accumulation of uterine secretion between the uterine mucosa externally and the chorionic and amniotic membranes internally (Fig. 1). It is separated from the true amniotic fluid by the amnion and chorion. Hydrorrhœa never occurs before the fourth month of pregnancy because prior to this period the decidua vera and reflexa have not yet agglutinated to obliterate the uterine cavity. Consequently any uterine secretion prior to the fourth month of gestation would drain through the cervix. Later than the fourth month the secretion will become encysted in the uterine cavity for a more or less prolonged period. The length of that period will depend upon the rapidity of the accumulation and the distance of the collection from the internal os of the uterus. Eventually, no matter how far the fluid may be from the cervix, it gradually burrows both by dissection and gravity between the membranes and the uterine mucosa until it bursts and escapes through the cervix. The fluid is clear and to the patient and doctor is indistinguishable from amniotic secretion. It is frequently tinged with blood due to the sudden separation of the membranes from the uterine wall at the lower pole of the collection. Usually, for several days after the rupture, there is a constant drainage of a clear or slightly blood-stained fluid. Sooner or later the detached membranes adhere and the cavity is obliterated; the fluid ceases to escape and begins to accumulate anew only to burst through again. This may repeat itself several times.

Invariably the escape of the fluid is mistaken for rupture of the bag of waters, and both the doctor and the patient are held in suspense for the beginning of labor that does not, as a rule, set in. The amount of fluid that may so accumulate before rupture will vary with the height of the collection in the uterus and the firmness of the union between the decidua vera and the decidua reflexa. In one of my cases the amount could not have been less than a pint, and the accumulation and rupture were repeated five times during the one pregnancy.

When rupture takes place it is impossible to distinguish between it and rupture of the membranes and escape of the amniotic fluid. The diagnosis

can be made only after the lapse of a few days. Once the membranes have ruptured and the liquor amni has escaped, labor must come on. The interval very rarely exceeds 4 days. When it does the diagnosis may be seriously questioned.

On the other hand, the bursting of a collection of hydrorrhœa does not predispose to the onset of labor. The rupture is usually neither preceded nor followed by any pain.

Textbooks rarely mention hydrorrhœa gravidarum or give it but scant consideration. Yet it is a common malady and is overlooked because it is so seldom understood. In a recent meeting of a society of eminent gynecologists and obstetricians a very pronounced case of hydrorrhœa gravidarum was reported as a premature rupture of the membranes and escape of the liquor amni at the seventh month, and the pregnancy went on to the full term. When told later that his case was one of pronounced hydrorrhœa, the author confessed that he had never heard of the condition.

It is tempting to assert that hydrorrhœa gravidarum is a sequence of a chronic endometritis, but the truth of the matter is that we know nothing of its causation. In one instance the author was compelled to do a hysterectomy 3 months post partum for a bleeding submucous fibroid. In her last pregnancy this patient had had a hydrorrhœa that had burst twice. This is the only case in which a possible cause could be demonstrated. In none of the other cases was there anything even remotely suggestive of a cause. Eleven undoubted cases have been under the author's observation in the past 3 years. Many minor discharges of fluid simulating small collections of hydrorrhœa were also seen, but though suspicious the element of doubt in the diagnosis makes it imperative to leave them out of the reckoning.

The number of times that the fluid may accumulate after bursting varies considerably. Among the author's cases one ruptured seven times with a large amount of fluid on each occasion. Ordinarily there is but one rupture late in the pregnancy. Not infrequently under the stimulus of uterine contractions at the onset of labor an hydrorrhœa may rupture and give the impression of an early rupture of the membranes. Many ingenious explanations have been offered to describe how rupture of the membranes may occur and yet the forewaters be prevented from

escaping. The real explanation is found in the rupture of a hydrorrhœa.

The following case will illustrate the course of the disease.

The author was called in consultation in a case of pyelitis of pregnancy. Patient was 6 months pregnant. When palpating over the pregnant uterus there was a sudden painless rush of fluid that flooded the bed. For 4 days the patient discharged a watery fluid tinged with blood. The onset of labor was awaited at any moment. Suddenly the fluid ceased and pregnancy went on normally. Subsequently she had three similar floodings and a last one shortly after labor set in. The patient had lost her first and only child in labor and the author was requested to take care of her in this pregnancy. Knowing her history of repeated hydrorrhœa the question at once arose whether the amniotic sac had really ruptured. It was later found intact and the membranes had to be ruptured artificially at the end of the first stage. One year ago she gave birth to her third child with a history of hydrorrhœa almost similar to that of the second pregnancy. Her first pregnancy was free from this complication. Some pathological change in

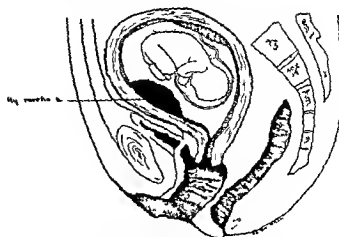


Fig. 1. Hydrorrhœa at fifth month of gestation.

the uterine mucosa must have taken place between the first and the second pregnancy. There was no menstrual disturbance or other symptoms to suggest a cause.

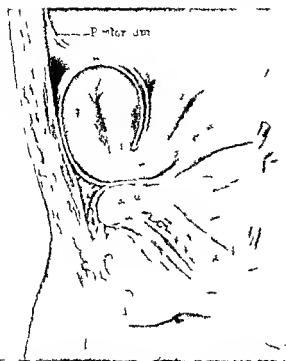


Fig. 1 The usual result of reduction *en masse* is to force the sac and strangulated contents to a preperitoneal position. This has been found to occur in 77 per cent of the cases.

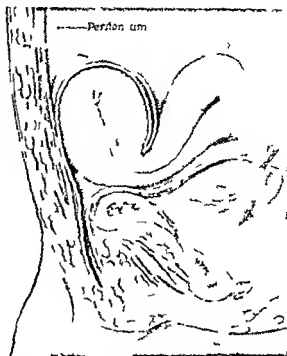


Fig. 2 In 15 per cent of the cases of reduction *en masse* the strangulated sac was displaced from the inguinal to the preperitoneal pouch of an inguinopreperitoneal hernia without disturbing the inguinal sac.

peristalsis was visible nor was there evident distention of the abdomen was flat to percussion and no peristaltic sounds were heard on auscultation. The liver, kidneys and spleen were not felt nor were there palpable masses. There was slight tenderness in the epigastrium but the remainder of the abdomen was non-tender without spasm or rigidity. The left internal inguinal ring was normal while the right ring was dilated. However, no mass or sac could be felt through this ring and there was no impulse on coughing. Both testicles were within the scrotum and showed no abnormality. Rectal examination was negative.

Laboratory examination of the urine showed the color to be amber, reaction acid, specific gravity 1.026, albumin slight trace, sugar none. Microscopic examination negative. Examination of the blood showed hemoglobin 100 per cent, white blood cells 16,000, differential count normal. The Wassermann test gave a negative reaction. Non-protein nitrogen was 42 milligrams per cubic centimeter, chlorides 455 milligrams per cubic centimeter.

The following day, January 17, all symptoms had subsided and the patient felt well. His temperature was normal but the white blood count was still elevated to 15,500. On January 18 there was no change; the patient was symptom free and sitting up in bed enjoying a book. The abdominal examination was as recorded except that the epigastric tenderness had disappeared. During the early morning of January 19 the patient again began to have right lower quadrant pain which was followed by vomiting. The pain originated at a point just above the right internal inguinal ring and radiated into the epigastrium. There was a tender mass about 5 centimeters in diameter just below McBurney's point. Slight spasm was felt over the mass but no rebound tenderness was present. The right internal canal was empty and the mass could not be felt through the internal ring or by rectal examination. In reviewing the case it appeared that at his previous illness he had reduced *en masse* the strangulated hernia and for some reason

the strangulation was temporarily relieved only to occur at the present time.

Final diagnosis. Reduction of strangulated inguinal hernia *en masse*. Operation advised and accepted.

Operation. Under nitrous oxide-oxygen anesthesia a high inguinal incision was made. The inguinal canal was opened and found to be empty. The mass could not be reached through the internal ring so the wound was extended upward and the internal oblique and transversalis muscles were opened in the plane of their fibers, thus exposing a hard, fluctuant, thick-walled mass outside of and depressing the peritoneum. The mass was opened, bloody fluid was evacuated, 30 centimeters of parietal small bowel resected, an end-to-end anastomosis was done with silk, and the bowel replaced. A clamp was then inserted through the internal ring, the sac grasped and brought down to the inguinal canal to re-establish the normal relations. After the incision in the internal oblique was sutured, the sac was ligated at its neck and excised, and a Halsted repair was done. The operation was well tolerated. The postoperative course was afebrile and the wound healed firmly by first intention. The patient was discharged well on the eighteenth day after operation.

The history of this case is unique; that of Walsham's second case being the only one which is similar to it to be found in the literature. The reduction *en masse* did not result in complete strangulation and was followed by an interval of 3 weeks during which the patient was free from symptoms before gangrene of the bowel developed. In Walsham's case a free interval of months occurred before there was a return of strangulation.

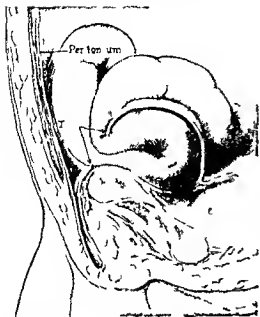
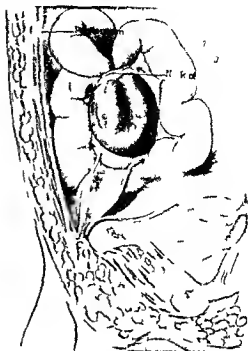


Fig 3 R duct by po te pt f th
d d l t f th str out ted sc b h d th
p b Th mp o pe s t e t h c k f th
a t h p t of rupt e



F 4 A om wh t d gr m t c pr t t f
La sd pt f d c t one by d m f
d c l l t Th p hed up a d c l l t t
ff nd t t t loop of bo lf with the t
m Th y unusual occ dh o
t r p t n l c s s

REVIEW OF CASES

The report by Corner and Howitt in 1908 recorded 137 instances of reduction *en masse* of strangulated hernias. The value of this study is materially diminished by the lack of authority of the cases reported and by the absence of a bibliography. Moreover these authors omit data that were considered desirable to analyze so that it was necessary to review the previous reports to obtain full information on some topics. Unfortunately, not all of the earlier papers were available and in others the very information desired was omitted so that in the review of the separate topics the number of cases from which data was obtainable for statistical study was recorded. To the 137 cases reported by Corner and Howitt are added 56 of recent occurrence giving a total of 193 cases reported to date. This total includes 2 cases of obturator hernias (37 and 160) one of umbilical hernia (1) which after careful consideration have been excluded from the series leaving 190 cases. Both the cases of obturator hernias were considered to be instances of spontaneous reduction *en masse* by muscle action. One may consider them also as merely strangulated obturator hernias. The case of umbilical hernia could be partially reduced *en masse* but shortly the tumor

returned and it was operated upon with the tumor out and as a strangulated umbilical hernia. Of the remaining cases all are either of the inguinal or femoral types.

ETIOLOGY

Reduction of a strangulated hernia *en masse* usually results from taxis but it may occur spontaneously or from an incomplete operation. The mechanism of spontaneous reduction is somewhat mysterious but it is possible that if an incarcerated hernia is present the result can be obtained by a shifting of the strangulated loop from the inguinal to the properitoneal locus of a bilocular sac.

Before the development of an aseptic technique operative procedures for strangulated hernia often consisted of division of extraperitoneal structures without opening the sac (fear of peritonitis). This and other equally blind procedures have resulted in 8 cases of reduction *en masse* at the time of herniotomy.

In 138 cases 83 or 60 per cent were reduced by a physician 48 or 35 per cent were reduced by the patient and in 7 or 5 per cent reduction was

U f ly th p p l T q t M t h b d Th m
p ese th po t t d d l

spontaneous. Thus it is that taxis is responsible for the accident of reduction *en masse* in 95 per cent of the cases and this fact is one of the very good reasons for the substitution of early operation for taxis in the treatment of strangulated hernia. Some surgeons feel that manipulation should never be used for example MacLaurin is quoted "I have no hesitation in saying that it is safer to do an early operation even by candle light in a bush humpy without a nurse and by local anaesthesia than to venture upon the perilous seas of taxis. One must appreciate that taxis was the accepted method of treatment of strangulated hernia of our predecessors everyone trying his hand (and strength) before resorting to operation. So that in a report covering the last two centuries the proportion of cases reduced by a physician will be higher than is to be expected in the future. In fact if only the cases reported in the last 20 years are considered it is found that the doctor is responsible for only 33 per cent rather than 60 per cent of the false reductions. But it is probable that we will always have ill advised prolonged and violent taxis practiced by the patient or his friends and so the occurrence of reduction *en masse* will continue.

PATHOLOGY

Sufficient description was found in 110 cases for a study of the result of the accident of mass reduction. In 102 or 92.8 per cent of these the sac was displaced to the properitoneal position and of these in 85 or 77.3 per cent the entire mass was outside of the inguinal canal (Fig. 1) while in the remaining 17 or 15.5 per cent an inguino-properitoneal sac was present with the strangulated viscus in the properitoneal position (Fig. 2). In 8 cases or 7.2 per cent the false reduction occurred by rupture of the sac and displacement of only the strangulated viscus. It is probable that this percentage is high since such an unusual event will probably always be described. If this proportion is computed on the basis of the entire series it is found that rupture of the sac occurs in only 4 per cent of the cases. Two varieties of this latter condition are found. The first described by Blackman is rupture of the posterior wall of the sac with displacement of the bowel behind the pubis (Fig. 3). The strangulation persists from pressure at the neck of the sac or at the point of laceration of its wall. The second type results from invagination of the sac like the finger of a glove turned inside out with the tearing off of a collar of tissue which strangulates a loop of bowel free within the abdomen (Fig. 4). Reduction *en masse* by rupture of the

sac is caused by violent manipulation and since there have been no recent cases of this condition it is probable that it will become of historical interest only.

The usual method of false reduction by displacement of the mass to the properitoneal position occurs in three ways. The most common method is the conversion of an inguino-properitoneal hernia into the properitoneal type. The presence of a preformed properitoneal pouch may offer a point of least resistance for the displacement of the strangulated contents of an inguinal hernia and since the inguinal sac is usually small in these cases it is not difficult to shift it into the properitoneal pouch.

The assumption of the existence of a preformed properitoneal sac explains the mechanism of the act of mass reduction in many cases. It gives a reason for the discrepancy occasionally observed between the size of the hernia seen in the inguinal canal before reduction and the much larger sac found at operation. Finally it explains some of the bizarre positions assumed by the displaced tumor such as between the pubis and bladder deep in the pelvis in the iliac fossa or even posterior near the sacro-iliac joint. If a properitoneal pouch occupied any of these positions prior to reduction then the strangulated mass would be displaced to the location of this sac.

The second method of displacement to the properitoneal position is by separation of the sac from the surrounding tissues and particularly the neck of the sac from the internal ring. The entire mass is forced through the fascial ring to a properitoneal position without relieving the strangulation at the neck of the sac. It is probable that this is the usual mechanism involved in the reduction *en masse* of femoral hernias. Recently some authors have doubted the possibility of such an event but there appear to be well authenticated cases proved by operation or postmortem examination in which this separation of tissue structures has resulted from vigorous manipulation.

The third means of properitoneal reduction is by the removal of the strangulated bowel from the inguinal to a properitoneal pouch of an inguino-properitoneal hernia without dislocating the inguinal sac. Moynihan feels that these cases should not be considered as reduction *en masse* but all the essentials of diagnosis and treatment which prevail for the condition apply to this group so that the failure to displace the inguinal sac appears to be of only minor significance.

The great importance of the presence of a properitoneal diverticulum of an inguinal hernia in

permitting reduction *en masse* has been shown and it is of interest to see how such a condition is brought about. Halstead considers the most important factors to be

a Pressure of an imperfectly fitting truss which closes the external ring but not the canal

b Repeated and unrestrained efforts at reduction of an inguinal hernia which has a narrow neck to its sac

c Congenital defects such as undescended testicle, narrow external ring or congenital peritoneal diverticulum

DIAGNOSIS

The history may give the only clue to the diagnosis of reduction *en masse*. The usual sequence of events is that a hernia of some years standing becomes strangulated and is reduced with more or less difficulty. At the time of reduction an absence of gurgling, an unusual amount of pain, a sudden giving way of resistance or other unusual features may be noticed. Partial temporary relief may follow this maneuver but usually there is a persistence of local pain, colic, vomit, in obstipation and distention and the patient presents obvious symptoms of intestinal obstruction.

The local diagnostic signs are quite variable. In 100 cases in which definite information is obtainable 45 per cent show no local abnormality, in 35 per cent a tumor is felt high in the canal or above the internal ring, in 16 per cent a palpable tumor is felt in the lower abdominal quadrant and in 1 per cent elevation of the testis of the affected side is observed. In many of these cases mention is made of an empty canal or a dilated internal ring. Impulse on coughing is rarely elicited. If the history does not arouse suspicion the local diagnostic signs are often not sufficiently obvious to attract attention and this probably accounts for the failure to diagnose the condition until abdominal exploration or postmortem section is done. Rarely is the pre-operative opinion as certain as was that of Dupuytren who, being misled by the patient's history, operated upon the wrong side and finding nothing, opened the opposite site to relieve a strangulated loop.

1ge. In 186 cases the average age was 49 years. The youngest patient was 13 years and the oldest was 79. Only 8 per cent of the subjects were under 30, while 69 per cent were between 30 and 60 and 23 per cent were over 60 years.

Sex. Of the 181 cases, 158 or 87.3 per cent were males and 23 or 12.7 per cent were females.

Type of hernia. In 188 cases, 164 or 87.2 per cent were of the inguinal variety while 24 or

12.8 per cent were of the femoral type. That 2 cases of obturator and 1 of umbilical hernia have been reported but are excluded from this series has been mentioned.

Side involved. Of 154 cases the right side was involved in 99 or 64.3 per cent, the left side in 55 or 35.7 per cent.

Duration of hernia prior to reduction *en masse* in 116 cases

| Und | day | Cases | P |
|------------|-----|-------|----|
| 5 to 15 | 1 | 3 | 9 |
| 15 to 30 | 1 | 14 | |
| 30 to 60 | 1 | 1 | 13 |
| 60 to 90 | 1 | 4 | 35 |
| 90 to 120 | 1 | 4 | 1 |
| 120 to 150 | 1 | 1 | 17 |

Many authors merely state that the hernia was present for a long time.

Surgical approach

| | C | P | I |
|---|-----|----|---|
| Inguinal incision | 3 | 76 | |
| Rectus abdominis incision | 7 | 18 | |
| Combined inguinal and abdominal incisions | 9 | 6 | |
| Total cases | 149 | | |

In the majority of the earlier reported cases an inguinal incision was used but the development of modern methods has resulted in the performance of abdominal exploration in 10 per cent of the recent subjects. In Eliason's patient and in my own a McFurney type of incision was used to expose the tumor or to enter the abdomen. This maneuver would appear to be of some value in conjunction with the inguinal exposure since the strangulated mass often cannot be reached from the inguinal canal without cutting across the fibers of the internal oblique muscle and hence weakening the abdominal wall. In case of a doubtful diagnosis an exploratory incision near the midline is to be preferred.

Mortality. Total cases 185

| | Case | P |
|-----------------|------|----|
| Inguinal hernia | | |
| Recovery | 97 | 60 |
| Death | 67 | 4 |
| | 64 | |
| Femoral hernia | | |
| Recovery | 7 | |
| Death | 1 | |
| | 24 | |

SUMMARY AND CONCLUSIONS

1. The reduction *en masse* of strangulated hernias is of rare occurrence being observed in 0.0073 per cent of hernias and in 0.3 per cent of those

which are strangulated. This gives an incidence of the accident in 1 in over 13 000 cases of hernia.

2 A study was made of 190 cases and it was found that this event happened most frequently in middle aged male subjects who have had a right sided inguinal hernia for many years.

3 The strangulated mass is usually forced to a preperitoneal position though the accident has occurred by rupture of the sac and displacement of only its contents. The physician is responsible in 60 per cent of the cases.

4 The presence of a preformed preperitoneal sac is the greatest factor in permitting the accident and such a pouch is probably most frequently formed by the use of a poorly fitting truss.

5 The diagnosis is made from the history of continuance of symptoms of intestinal obstruction after the apparent reduction of a strangulated hernia. Local signs of the disorder are often absent but a tumor may be palpated above the internal inguinal ring or in the lower abdominal quadrant.

6 Early operation is indicated since the condition carries a mortality of 50 per cent in femoral hernia and 40 per cent in the inguinal type.

7 The possibility of reduction *en masse* of a strangulated hernia is one of the reasons for the abandonment of taxis by the medical profession.

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RECURRENCE FOLLOWING SUPRAPUBIC PROSTATECTOMY FOR BENIGN HYPERTROPHY¹

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ONE phase of prostatectomy for benign hypertrophy has received but little attention in the literature and that is the question of recurrence. It has generally been assumed that with the removal of the prostate and the return of the patient to his daily routine his relief is complete and the possibility of further trouble from the prostate which now reposes in a bottle on some laboratory shelf is out of the question.

Every now and then however a case is reported in which recurrence has followed an apparently complete removal of the prostate. Because of the infrequency of such cases serious thought has not been given to the matter.

A discussion of this subject should be most carefully approached from several angles and before considering these angles I would like to report the 2 following cases. Both the original operation and the operation for the recurrence were performed by myself so that all data with regard to the prostatectomy and specimens are at hand. Three other cases operated upon for so called recurrences are not included in this report for the reason that the prostatectomy was done by other surgeons in other hospitals.

CASE 1. T. J. S., aged 64 years, entered the Presbyterian Hospital February 25, 1914. Twenty years ago a diagnosis of pulmonary tuberculosis was made; thereupon the patient spent 2 years in a sanitarium. At the end of which time he was pronounced cured. As a young man he had an attack of gonorrhea from which he made a complete recovery without complications. His present illness began 10 years ago at which time he had difficulty in holding his urine; would lose a few drops and wet his underwear. Frequency of urination had been present for many years but gradually increased until at present he is obliged to void once every hour. Associated with the frequency he has had a great deal of burning in the urethra. He is obliged to arise three times at night. One week ago he developed complete retention of urine and the use of a catheter followed by bladder irrigations was necessary. He strained considerably in passing urine. As a result he developed an inguinal hernia for which he wears a truss.

Examination. The pupils reacted to light and accommodation. Some dullness was present over the apex of the right lung with tubular breathing. The heart was negative. The liver and spleen were negative. He had a right inguinal hernia. Rectal examination showed an enormous hypertrophy of both lateral lobes of the prostate. No signs of carcinoma were noted. Examination of the blood showed hemoglobin 80 per cent, leucocytes 6,200. Systolic blood pressure was 135. Urinalysis showed reaction acid + albumin o casts o pus ++++. Roentgen ray examination was negative for stone. Cystoscopic examination

showed severe cystitis. There was a large cleft above with an enormous protrusion of the lateral lobe and moderate trabeculation of the bladder.

Operation—suprapubic prostatectomy—was done March 3, 1914 (ether anesthesia). The prostate was removed intact no tags. Convalescence was uneventful. Patient left hospital March 19, 1914. Microscopic examination of specimen showed the typical picture of benign hypertrophy of the prostate; no signs of carcinoma.

Patient again entered the Presbyterian Hospital January 1, 1926. Since the prostatectomy 12 years ago he has been free of urinary symptoms except for several attacks of profuse hematuria which began 1 year ago. The present attack of hematuria for which he entered the hospital began 10 days ago without any apparent cause and was associated with large clots. Since this attack began it has been necessary to catheterize the patient several times. During the past 10 days he has had a good deal of pain on micturition also in the suprapubic area and burning in the penis. Two days before entrance the hospital he had a sharp attack of an inguinal hernia.

Examination of the head and neck was negative. There was a reduplication of the first sound at the apex with an occasional extra systole. The abdomen showed nothing abnormal. The external genitalia were negative. He had a right inguinal hernia for which he wore a truss. Roentgen ray examination was negative for stone. Urinalysis revealed albumin + pus + gross blood +. Blood examination showed red cells 4,560,000 white cells 1,400. Blood pressure was systolic 158 diastolic 95. Rectal examination was negative.

Examination for residual urine was made and showed that after the hematuria was stopped the amounts varied from 3 to 8 ounces. Cystoscopic examination was made January 25, 1926. There was a definite notch formation at 11 o'clock and what appeared to be a good sized intravesical protrusion of a right lateral lobe. Many extremely large dilated tortuous blood vessels were seen around the margin of the sphincter as well as on the trigone. Culture of bladder urine showed the bacillus pyocyanus.

A second suprapubic prostatectomy was done under ethylene ether and anesthesia on February 2, 1926. Examination showed the presence of a wedge shaped tumor firm in consistency and 5 centimeters long 3 centimeters wide and 2 centimeters thick. The surface was irregular due to the presence of small adenoma nodules. This tumor was easily shelled out with the finger and bleedings were controlled with packs. Subsequent course was uneventful. Patient left hospital February 17, 1926.

Diagnosis: benign hypertrophy of an adenomatous type. CASE 2. J. S. E., aged 52 years, referred by Dr. B. Felsenstein entered the Alexian Brothers Hospital December 14, 1917. Patient has had two attacks of gonorrhea from which he made a complete recovery without complications. He has suffered from chronic constipation for 23 years. His present illness began about 3 years ago at which time he noticed that his stream was very small. At about the same time he was obliged to arise once at night to void. There had been a gradual increase in the number of voidings at present he arises three times at night. He has pain in the glans penis following urination.

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The question of whether or not one is dealing with a true recurrence of benign hypertrophy after prostatectomy can be settled only by very careful investigation of the case so designated. In order to designate a case as one of true recurrence it is imperative that certain conditions be definitely established. First in a given patient upon whom a proved complete prostatectomy has been done it is of course necessary (1) that considerable time should elapse between the operation and the onset of the present symptoms (2) that during this interval the patient be free of symptoms (3) that the present symptoms are really due to a benign hypertrophy which has recurred as proved by rectal and cystoscopic examination and (4) that after surgical removal the histological examination of the specimen corroborates the diagnosis of true recurrence.

In the two cases reported in this paper the periods between the two operations were 10 and 12 years respectively. Similar long periods between operations have been reported by Blum 9 years Casariego 10 years Fronstein and Meschebowski 12 years Gregora 16 and 14 years Takahashi 6 years Thomson Walker 10 years and Zuckerkandl (autopsy case) 6 years.

In making the diagnosis carcinoma of the prostate should be excluded. It is possible to overlook a small area of carcinoma in a prostate removed for benign hypertrophy with the result that it is not found at operation or on histological examination. As a rule however when the so called recurrence is due to a carcinoma that was present and overlooked at the time of the prostatectomy the rectal examination shows unmistakable signs of carcinoma. Andre has stated that there is no such thing as recurrence after prostatectomy for simple hypertrophy the recurrence always being the result of a carcinomatous prostate at the time of the initial operation. The fact that so proved cases of true recurrence have been reported surely discredits Andre's view.

On the other hand the secondary symptoms may be due to a stricture of the urethra quite independent of the previous prostatectomy or the stricture may be the result of the prostatectomy. In some instances the secondary symptoms may emanate from a disease of the nervous system such as tabes dorsalis. These points

should not be too lightly considered for they are matters of importance in differentiating the causes. It is essential also to exclude certain lesions of the bladder for example a stone may be productive of the present symptoms. Sometimes an overlooked diverticulum may cause the symptoms but rarely is carcinoma of the bladder found.

In making a diagnosis of recurrence much will depend of course upon the completeness with which the prostatectomy has been carried out. If only incompletely done that is piecemeal or if only a middle lobe has been removed and the lateral lobes have been left behind it is hardly justifiable to talk of recurrence.

In one of the 3 cases not included in this paper the patient was told that he had had a complete prostatectomy at operation. I removed two very large lateral lobes. In the second case a competent urologist removed the prostate at operation. I found a median bar probably overlooked by the previous surgeon. In the third case I found two lateral lobes and a stone at operation. Evidently only the middle lobe had been removed.

But in the 2 cases reported in this paper I performed the suprapubic prostatectomy and the records and pathological reports as well as the gross specimens and my own memory are evidences of the fact that a complete prostatectomy was done.

How then can we explain these recurrences? The answer is that recurrences originate from small amounts of prostatic tubules harbored in the prostatic capsule. In cases in which the prostate did not enucleate cleanly the removal being necessarily piecemeal a small adenoma nodule which subsequently may become hypertrophied may easily be overlooked. Let me emphasize here that in both my cases the primary prostatectomy was complete.

Cases belonging to this very interesting group have been reported among others by Blum, Cahn, Cañero, Frank, Fronstein and Meschowski, Gregora, Ilyes, Loumeau, Lumpert, Nogues, Pauchet, Takahashi, Thomson, Walker, Zucker, Kandl and recently Cunningham⁴ reported 3 cases.

To reiterate recurrences can be explained in one of two ways.

1. When the removal is so difficult that the prostate can be removed only in pieces or by morcellement it is readily comprehensible how a small nodule may be left behind and later, the nodule having enlarged, causes obstruction.

2. A possibility which presents itself is that the recurrences may originate from small gland tu-

bules in the layers of the capsule remaining in the prostatic bed. Being microscopic in size they cannot be recognized, of course, at operation.

Gregora reviewed the literature and found 30 cases reported. This is surely a very small number in view of the large number of prostatectomies that are performed. Perhaps too recurrences are not more frequent because of the age of the patients, operations for prostatic hypertrophy are practically always done in old men and it is probable that there would be more recurrences if the patients were younger and would be more likely to live longer. Gregora states that there may be recurrences from the surgical capsule thus illustrating how a recurrence is possible even after total removal of the primary tumor.

SUMMARY

1. True recurrences following suprapubic prostatectomy for benign hypertrophy do occur although they are very rare.

True recurrences must be differentiated from pseudorecurrences in which the recurrent symptoms are due to carcinoma, stricture, stones, diverticula, tubes, etc.

3. Careful examination of the removed specimen as well as of the prostatic bed should be done so as not to overlook small adenoma nodules which may have been left behind.

4. In case the prostate has been completely removed and no nodules are overlooked, recurrences probably originate from small nests of glands in the prostatic bed.

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DEEP BLOCK ANÆSTHESIA OF THE SECOND AND THIRD DIVISIONS OF THE FIFTH NERVE

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OPERATIONS about the jaws, mouth and face may frequently be carried out under anæsthesia produced by blocking the second and third divisions of the fifth nerve deep in at their exits from the cranial cavity. For some procedures this anæsthesia may be the one of choice and the rather wide range of usefulness is indicated in the summary.

The operative medication is important as for any anæsthesia, however, if full co-operation of the patient is desired during the operation, hypnotics are not given in full dose and we have omitted preliminary medication entirely several times. The preliminary winning of the patient's confidence, the reducing of the pain of injection to a minimum and the avoidance of operating outside of the field of anæsthesia are as important as the use of sedatives before operation.

The technique of the injection is not difficult and so far we have had no real difficulties from its use. A good knowledge of the anatomy of the region is of course important and this combined with practice will be of more benefit than any set of rules for the exact movements of the needle.

The injection of novocain is not comparable to the injection of alcohol for neuralgia even though the procedures are similar. In anæsthesia a rather harmless fluid is used, accurate location of the nerve is not necessary and fairly large amounts of fluid can be used without harm. In using alcohol the procedure must be much more exact, the nerves accurately located (if relief of any duration is hoped for) and because of the effect on the surrounding tissues, relatively small amounts used. Many complications may arise from the use of alcohol and disastrous results occur such as deafness, blindness, necrosis of bone, sloughs of soft tissue and fibrous ankylosis of the lower jaw.

When the injecting is done ahead of the advancing needle, there need not be extreme discomfort. There is usually sharp pain when the nerve trunk is struck, although with infiltration of the area without directly puncturing the nerve, even this discomfort may not occur. Palpitation occurs as frequently as when novocain-adrenalin solutions are used elsewhere. Syncope occurs rarely and if it is recognized at the onset, simply lowering the head of the table will suffice in most cases. We do not do the injection with the patient sitting erect.

When complete anæsthesia is obtained it is usually such a revelation to the patient that he is apt to co-operate very well. Notable examples of this occur in patients with fractured jaws. Even though relieved of pain by the injection, we have found them able to tell when the jaws have been brought into their normal occlusion. One patient (of this series) who suffered from an automobile accident, had his left eye blinded and the whole upper jaw pushed far over to the right. In the reduction it was necessary to manipulate the lower border and floor of the orbit under the one good eye. This required close co-operation and he was able to tell each time during the operation when he felt any sensation around his good eye. The importance of this was that there might possibly have been some damage to the eye muscles or even to the optic nerve if the patient had not been awake and able to talk.

Postoperative pain (as the effect of the novocain is wearing off) is not as marked as that which frequently follows peripheral block of the infra-orbital or mandibular nerves and there is not the persistent soreness to contend with about the point of injection that occasionally follows injection of the peripheral branches.

TECHNIQUE OF THE INJECTION

It is well to have a skull available for reference during the injection. Usually a No. 20 3½ inch needle is used with an ordinary 2 cubic centimeter glass syringe, but the special heavy, rather blunt needles with centimeter markings may be used. The use of the same outfit each time may make for more accurate work.

The first superficial landmark is the lower border of the zygomatic process at about its middle. The next landmark is the condyle of the lower jaw, this can usually be felt by palpating deeply back along the lower border of the zygoma and having patient protrude the lower jaw. The condyle is felt as it slides forward on the articular tubercle. If not felt, the lower border of the zygoma 2 to 2.5 centimeters in front of the tragus is the landmark.

Superficial anæsthesia is done with a fine needle. The long needle is then inserted slowly and novocain injected ahead of it through the sigmoid fossa (space between the condyle and coronoid of the jaw) and in through the deeper tissues (40 to

50 millimeters average 43—Blair) until it gently strikes the external surface of the external pterygoid plate (the third landmark). If the needle penetrates deeper than would be expected from the size and contour of the skull without striking the process it should be withdrawn somewhat and thrust slightly forward and upward for it may have passed behind the process (Blair). This would usually be evidenced by the patient's feeling some pain in the lower jaw because the third division lies posterior to the posterior edge of the plate. From here by short withdrawals and reinsertions the needle is carried up to the base of the plate until the under surface of the great wing of the sphenoid is felt. The sphenomaxillary fossa lies forward and the foramen rotundum just above the top of the plate. Therefore to inject the second division the point of the needle is carried forward (keeping well up against the greater wing) until it drops off the pterygoid plate. The point should not go over 0.5 to 1 centimeter deep into the fossa. If the nerve or its immediate vicinity is struck the patient will have pain in the upper lip and teeth and it is at this point that the solution is to be deposited—2 to 4 cubic centimeters (1 per cent solution with 0.5 to 1 drop of adrenalin per cubic centimeter) are usually enough if a close hit has been made. For anesthesia (in contrast to an alcoholic injection for fifth nerve neuralgia) a direct hit is not needed and so more than 4 cubic centimeters may be needed to get sufficient absorption into the nerve. As the needle is worked forward on the pterygoid plate it may have to be withdrawn a considerable distance to get the correct forward angle from the skin puncture. With practice and observation of the variations of the bony plate fairly direct passage can be made with the needle from the first skin puncture. Location of the second division may be a little more difficult than of the third division because from the skin puncture the needle tends to travel almost straight in to the third division whereas the second division lies farther forward in the sphenomaxillary fossa and the reflection of the anterior edge of the pterygoid plate from the base of the sphenoid may present a distinct elevation that the point of the needle must surmount before it can drop into the fissure.

The sphenopalatine ganglion lies a little lower than the second division and if the injection is not placed high enough there might occur some anesthesia about the palate without anesthesia of the external face and lip.

To inject the third division the needle is carried backward being kept up in contact with the under surface of the greater wing of the sphenoid



Fig. 1. Show the bony landmarks clearly by palpation. The lower border of the zygoma is determined first and then the condyle by having the patient open the mouth and protrude the lower jaw. It is nearly always demonstrable that as it slides forward on the articular tubercle (meniscus) the point of insertion of the needle is 2 to 2.5 centimeters in front of the tragus just below the lower border of the zygoma. From here it passes between the coronoid process and the condyle of the lower jaw (sphenoid fossa) and just anterior to the articular tubercle. Occasionally it may be necessary to have the mouth held open so the space between the zygoma and the mandible may be increased.

The foramen ovale is just above and behind the pterygoid plate and just as the needle drops off of the plate the nerve is usually encountered as evidenced by pain in the lower jaw or ear. The solution is deposited here. The needle should not go back or deeper in more than 0.5 centimeters for fear of injury to the Eustachian tube or of puncturing the internal carotid or middle meningeal artery or of entering the pharynx. If the needle goes straight in just anterior to the articular eminence it may tend to pass entirely posterior to the pterygoid plate. For this reason it is seldom necessary to carry the needle very far posterior after the plate has been struck. On three occasions some fluid entered the pharynx when the third division was injected. No harmful effects resulted but this is certainly to be avoided.



Fig 2 Shw pp mt lt of dle dh
l dm k N dl p t d by t whld p c
wthm d l g ly O t c e d to th pt ryg d
pl t th n dle p es th gh th parot d gl d th
m et t mpo l d t m l pteryg id mu cl It
m y ls n o t e th t f c l ternal m d l
l ry middle m n gel nd e te c a t e e S far w
h a e ts n y t w d l t s f m th p sage of th
d l th o h th st t es l th o gh e h a d
l b n k hemo h g th o gh th n dl
A p o t d o th y B i k l l a f c t d h y o t p r s
m y l l w d p p e t t n f th dle with t d g
the pt ygo d plate m y l l o w t r y t the c l
a ty a trum if the b n ma l t y s n o t o g n z d

The general rules for the use of local anæsthetic formulated by Braun Labat Farr and others should be followed closely. Gentleness and quietness are prerequisites. The solutions, syringes and needles should all be checked properly. Asepsis rigidly enforced lateral movements of needles should not be made unless the needles are withdrawn and reinserted in the required direction. Injections should be made slowly and the plunger withdrawn frequently to see if blood is entering the needle. If blood does appear the needle should immediately be withdrawn from the area and preferably entirely withdrawn and washed out. In one patient there was brisk hemorrhage into the syringe and instead of withdrawing the needle 1 cubic centimeter of solution was injected directly into the artery. There was immediate severe occipital headache that persisted for about 1 hour. General anæsthesia as a supplement has not been necessary in this series but in 2 cases of radical dissections for carcinoma not recorded here it was thought best to change to it.

Additional injections of adjacent field are frequently necessary. The branches of the first division on the same or opposite side of the deep block



Fig 3 Sh w th ed p cou of the dl Afte g ty
t k th pt ryg d pl t by h o t w th d w l d
s t o s th p o t f th ed l d p t o th u d
r f o th g t w n f th phe d w h i s a h t t
h t a l e t the pt ygo d pl t F m o w n th
d r r f f th g t e g ally i m p o t t
l d m a k a s th pt ryg d pl t t l f
To inject th th d d th dl i n d h c k
d by h t w th d w l d e e t o g i t t h
pt ryg d pl t d h g h l d p a g s t th ph o d
w W h th p t n b o d f th pl t s h e d
th dl l p f f d the p t t l l y x p n c
m m t r y s e p a Th f d s u n j c t h It
n t a h s o l t y l t g t h p f d c t h t f
th r e v e h f j t g t h f d l f t n t h g h t h t
d t h t h h g t t n t m o t f t h d
m y h e d p t e d d l g t u m e h l d b l l w d f
th d e l p m e t f s e t h (T m n t m y b
s r y) It m p t t t t e m b h r l f t g
p o t e o l y o d p m th o s t t m t f r m t h
e d f the pl t D m e m y h d e t o t h i t l
c t d t e r y the middle m e l a t e r y th E t a
c h i a t u b e The p h r y n g e l m m a y e b p c
t d a d f l d g t t n t o t h t h o t (Th m h t h o
h p p n f o g h w e d e p t d i t h E t c h
t b e)

It s l o p o b l t o g t l y t h r h t h f o m
o l l n d j e t t h g h d u r t l y Th h o t b
d o e f n o h c a t t m p t h e m d t j e t t h f i r s t
d o b e t s t h g h t t h t p o b l p l y s
o f t h r n e d t h p t u e o f t h d m h t t
j t f y the p d e
T j e c t th c o d d the nee d l a r d f
w d t h t phe o m a l l r y f o d the f l d d p t d
h St w a p l d t o s h o w t h t h d d
e m g g f m t h f m o a l d the s o d d
c r s g t h p h e m l l r y f o s

may require anæsthetizing. The zygomatic supratrochlear and infratrochlear and external nasal branches are usually anæsthetized by a regional infiltration or block. The supra orbital branch is blocked directly at the supra orbital notch or foramen and the nasal nerve deep in the orbit at the anterior ethmoidal foramen which is approximately at the center of the medial wall

of the orbit. Any of the peripheral branches of either of the second or third divisions that have not themselves been blocked should be anesthetized if their field is to be invaded. Operations about the lower part of the ear and about the neck require local infiltration or superficial or deep block of the cervical nerves.

The solutions used are (1) For blocking the second and third divisions and their peripheral branches 2 per cent novocain with 1 drop of adrenalin to every 1 or 2 cubic centimeters. With accurately placed injections small total amounts are required and the amount of adrenalin is not excessive. (2) For deep block in the orbit 2 per cent novocain with 1 drop of adrenalin to every 4 cubic centimeters is used. (3) For local infiltration 1 per cent novocain with 3 drops of adrenalin to every 30 cubic centimeters of solution. (4) For regional block of the branches of the first division and for superficial and deep regional block of the cervical nerves 1 per cent novocain with 3 drops of adrenalin to 30 cubic centimeters.

SUMMARY

A total of 96 injections of the second and third divisions of the fifth nerve (second division 47 third division 49) were done on 54 patients (43 men 11 women) on whom 57 operative and 4 diagnostic procedures were carried out. Both right and left second and third divisions were injected on two occasions.

Excellent anesthesia was obtained in every case except in one in which uninjected ninth nerve fibers gave some discomfort and in three in which the radiocautery knife was used and the pain of the current tended to extend outside the field of injection. Several extremely nervous individuals including aged men and women, one imbecile, one frightened negro girl and two frightened foreigners went through their operative procedures excellently. In 11 patients no other anesthesia available would have been satisfactory. Tracheotomy was probably avoided in 7 patients by the use of the deep injection in place of any form of general anesthesia. No deaths occurred in the series.

Undesirable symptoms occurred twice. Once when about 1 cubic centimeter of solution was injected directly into an artery there was immediate and violent occipital headache. This lasted about one hour. In another patient who left the hospital right after his operation there was dilatation of the pupil following injection of the second division. This may have happened in others of the series but escaped notice. Temporary paralysis of the eyelids may prove a little annoying if too much fluid is deposited near the surface.

Pain and discomfort following the injection are rare. No patients have complained very much and the average discomfort is less than that following the average peripheral injection. One might expect stiffness of the jaws especially if much hemorrhage had occurred along the tract but we do not believe that persistent stiffness has occurred in this series. One patient submitted to the injection willingly four times, 1 patient three times and 2 patients on two occasions each.

Preliminary medication of morphine and atropine or morphine and hyoscine was given in all but 11 instances.

Operations were carried out as follows:

- Three radical for carcinoma of the antrum
- One simple for carcinoma of the face
- Four radical and 1 simple for carcinoma of the lip including the white line of vermillion border red lip flaps
- Six radical and 1 simple for carcinoma of the buccal mucosa
- Eight radical for block glanular dissection some of these classified as under carcinoma
- Three radical and 4 simple for benign tumors of the upper and lower jaws
- Three open reductions and 1 simple for fracture of the upper and lower jaws
- One bone graft for non union of fracture of the jaw
- One double osteotomy for deformity of the jaw
- Three drainage and osteotomy for the jaws
- One radical resection for ankylosis of the jaw
- Three osteotomies and plastic repair of the jaws
- Secondary repair of extensive facial injury
- Three extractions of teeth (impacted and loose)
- One exploration for broken hypodermic needle
- Two plastic operations for secondary repair of lip
- One harelip
- One operation for removal of bull's head antler

Injectations were done for

- One case of carcinoma for section of linual nerve
- One case of carcinoma for localization of pain
- One case of tic douloureux for localization of pain
- One case of apparently plain hysteria in which no history could be secured until anesthesia was obtained
- One case of hysterical opening of the mouth in which double dislocation had been diagnosed and bilateral open reduction proposed

Additional regional anesthesia was used in 30 instances including deep and superficial blocks of the cervical plexus, blocking the nasal nerves in the orbit at the anterior ethmoidal foramen and peripheral blocks of other branches about the face.

These operations were performed by the following methods: 1. In the case of the upper jaw, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the sublingual space and a small amount of anesthetic solution is injected. 2. In the case of the lower jaw, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the sublingual space and a small amount of anesthetic solution is injected. 3. In the case of the buccal space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the buccal space and a small amount of anesthetic solution is injected. 4. In the case of the mandibular space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the mandibular space and a small amount of anesthetic solution is injected. 5. In the case of the maxillary space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the maxillary space and a small amount of anesthetic solution is injected. 6. In the case of the infraorbital space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the infraorbital space and a small amount of anesthetic solution is injected. 7. In the case of the mental space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the mental space and a small amount of anesthetic solution is injected. 8. In the case of the submental space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submental space and a small amount of anesthetic solution is injected. 9. In the case of the sublingual space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the sublingual space and a small amount of anesthetic solution is injected. 10. In the case of the submandibular space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submandibular space and a small amount of anesthetic solution is injected. 11. In the case of the submaxillary space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submaxillary space and a small amount of anesthetic solution is injected. 12. In the case of the submental space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submental space and a small amount of anesthetic solution is injected. 13. In the case of the sublingual space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the sublingual space and a small amount of anesthetic solution is injected. 14. In the case of the submandibular space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submandibular space and a small amount of anesthetic solution is injected. 15. In the case of the submaxillary space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submaxillary space and a small amount of anesthetic solution is injected. 16. In the case of the submental space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submental space and a small amount of anesthetic solution is injected. 17. In the case of the sublingual space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the sublingual space and a small amount of anesthetic solution is injected. 18. In the case of the submandibular space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submandibular space and a small amount of anesthetic solution is injected. 19. In the case of the submaxillary space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submaxillary space and a small amount of anesthetic solution is injected. 20. In the case of the submental space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submental space and a small amount of anesthetic solution is injected. 21. In the case of the sublingual space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the sublingual space and a small amount of anesthetic solution is injected. 22. In the case of the submandibular space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submandibular space and a small amount of anesthetic solution is injected. 23. In the case of the submaxillary space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submaxillary space and a small amount of anesthetic solution is injected. 24. In the case of the submental space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submental space and a small amount of anesthetic solution is injected. 25. In the case of the sublingual space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the sublingual space and a small amount of anesthetic solution is injected. 26. In the case of the submandibular space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submandibular space and a small amount of anesthetic solution is injected. 27. In the case of the submaxillary space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submaxillary space and a small amount of anesthetic solution is injected. 28. In the case of the submental space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submental space and a small amount of anesthetic solution is injected. 29. In the case of the sublingual space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the sublingual space and a small amount of anesthetic solution is injected. 30. In the case of the submandibular space, the patient is placed in the supine position and the head is tilted back. The skin is cleaned and a small incision is made in the lower lip. A fine needle is inserted into the submandibular space and a small amount of anesthetic solution is injected.

SPASMODIC TORTICOLLIS

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VARIOUS types of operations for the relief of spasmodic torticollis have been described since Isaac Minnus a German Army surgeon sectioned the sternocleidomastoid muscle in 1641.

Finney and Hughson have reviewed several of the methods advised and have reported 32 cases of spasmodic torticollis in which an operation based on the method described by Keen was employed. Keen advised section of the spinal accessory nerve and the posterior divisions of the first three cervical nerves.

Sherington in 1907 called attention to the fact that the rigidity of the muscle (in decerebrate rigidity) immediately ceases on severance of the spinal afferent roots through which pass the afferent fibers from the muscle. Basing his opinion on this principle Foerster advised section of the posterior roots for the relief of spasticity in Little's disease. With the theory of the Foerster operation in mind Alfred Taylor sectioned the posterior roots of the upper four cervical segments in addition to a peripheral section of the spinal accessory nerve in a case of spasmodic torticollis with some improvement. McKenzie reported a case operated upon by Dr. Cushing in which there was an intrameningeal division of the spinal accessory nerve and a division of the posterior and anterior roots of the upper three cervical segments on the right side. The result in this case was an improvement beyond all expectations. In this communication McKenzie unaware of Taylor's case suggested an intraspinal division of the upper six cervical posterior roots plus a division of the spinal accessory nerve as perhaps a satisfactory method of treating cases of spasmodic torticollis. Coleman reported an aggravated case of spasmodic torticollis treated by section of the upper four cervical roots and an extracranial division of the spinal accessory nerve. The patient stated that while he felt there was great improvement immediately after the operation the maximum benefit was not obtained until about 9 months later.

The various theories in regard to etiology have been discussed by Finney and Hughson. They summarize as follows: The pathology of spasmodic torticollis is even more obscure than the etiology since no actual causative lesion has been demonstrated. The trouble whatever it is must be either of central or peripheral origin with the weight of authority at the present time rather

favoring the former. That the condition is a symptom of striatal disease as has been advanced by Babinski, Foerster and Cassirer is a view which is becoming more generally adopted. Foerster speaks of spasmodic torticollis as the cornerstone of the athetoid motility play. Rothfeld reports the case of a man 30 years of age who gradually developed a tendency to pull the head backward and to the left. In addition this patient had such symptoms of striatal involvement as salivation, masked face, absence of automatic swinging of the arms, clumsiness of the hands and a slow monotonous speech. The case had not had encephalitis. It would seem since the work of Froment and Carillon and the thesis of Thevenard that disturbances of postural tonus have acquired the right to be cited among the numerous sequelae of epidemic encephalitis. Sicard in discussing a case reported by Frieberg, Blanc and J. Picard ventured the opinion that section of the spinal accessory nerve should be confined to those cases in which the spasmodic movements are limited to the muscles of the neck and not accompanied by other symptoms of striatal involvement so often observed following an attack of encephalitis.

A study of the muscles which have to do with the various movements of the neck and head readily convinces one of the great difficulty in determining accurately what muscles or groups of muscles may be involved in the bizarre movements of spasmodic torticollis. Such a study also explains the great difficulty in obtaining a complete cessation of the spasmodic movements by the application of the usually recommended types of neurectomy in cases of this nature. A division of the posterior cervical roots will not suffice in all cases and when the condition is very much aggravated may have to be combined with sections of the upper four anterior roots.

The muscles which are involved in the movements of the head and neck are those which are located anterior and those which are located posterior to the cervical spine. These muscles with their action and innervation are listed in Tables I and II.

As the posterior neck muscles with the exception of the rectus capitis posterior major and minor and the obliquus capitis superior and inferior receive their innervation from the second to the eighth cervical nerves it is possible to di-

TABLE I—ANTERIOR NECK MUSCLES

| Muscle | Innervation | Action |
|--------------------------|---------------------------|---|
| Sternocleidomastoid | Spinal accessory | Pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |
| Platysma | Cervical | Flattens the neck; pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |
| Rectus capitis lateralis | Branch of cervical plexus | Flexes the neck; pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |
| Rectus capitis anterior | Branch of cervical plexus | Flexes the neck; pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |
| Longus capitis | Branch of cervical plexus | Flexes the neck; pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |
| Longus colli | Branch of cervical plexus | Flexes the neck; pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |
| Scalenus anterior | Branch of cervical plexus | Flexes the neck; pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |
| Scalenus medius | Branch of cervical plexus | Flexes the neck; pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |
| Scalenus posterior | Branch of cervical plexus | Flexes the neck; pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |
| Digastric | Branch of cervical plexus | Flexes the neck; pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |
| Omohyoid | Branch of cervical plexus | Flexes the neck; pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |
| Mylohyoid | Branch of cervical plexus | Flexes the neck; pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |
| Omohyoid | Branch of cervical plexus | Flexes the neck; pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |
| Sternohyoid | Branch of cervical plexus | Flexes the neck; pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |
| Thyrohyoid | Branch of cervical plexus | Flexes the neck; pulls the head to the opposite side; turns the head to the opposite side; flexes the neck. |

vide the anterior roots of the upper four cervical segments without rendering the patient incapable of performing the various neck movements through contraction of these muscles. Such an extensive anterior root section will paralyze such anterior neck muscles as the rectus capitis lateralis, the rectus capitis anterior and the longus capitis.

The integrity of the anterior neck movements however can be maintained through the combined contractions of the digastric, the stylohyoid, the mylohyoid, the omohyoid, the sternohyoid, the sternothyroid and the thyrohyoid muscles. These muscles which receive their nerve supply from the fifth, seventh and twelfth cranial nerves (Table I) by fixing the hyoid bone and the thyroid cartilage from above and below permit the neck to be moved forward and laterally through fairly normal limits. Such neck movements are re-enforced through the action of the scaleni muscles which receive their innervation from the brachial plexus and by that portion of the longus capitis which receives its innervation from the brachial plexus.

Should the anterior roots of the upper four cervical segments be divided, one might expect a

paralysis of the diaphragm through withdrawal of the phrenic nerve supply. As a matter of fact the phrenic nerve often receives a branch from the fifth cervical nerve which may maintain to a certain extent diaphragmatic contractions. On the other hand it has been demonstrated clinically that both phrenic nerves can be severed without jeopardizing respiration (2).

In the case to be reported in this communication there was marked involvement of the right sternocleidomastoid and the left posterior neck muscles, the left platysma, the left trapezius and later the right posterior neck muscles. This extensive muscular involvement could not be definitely determined at the time the patient was first seen. The movements were so complicated that an accurate estimate of all of the muscles involved could not be made until the movements of the groups principally involved were eliminated by some form of neurectomy. This emphasizes the necessity of varying the operative procedures according to the needs peculiar to the individual case and likewise the fact that at times several operative procedures may have to be done before all spasmodic movements are completely eliminated.

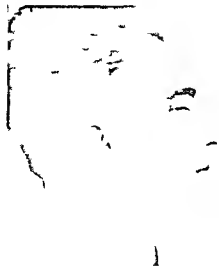


Fig 1A



Fig 1B



Fig 1C



A



B



C



Fig 3A



Fig 3B



Fig 3C

TABLE II—POSTERIOR NECK MUSCLES

| Muscle | Location | Action |
|-----------------------------|--|--|
| Trapezius | Spinal c. 1 to 6, 7 to 12, 13 to 14 | Flexes the head backward and the shoulders |
| Splenius capitis | Transverse processes of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |
| Splenius cervicis | Transverse processes of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |
| Levator scapulae | Dorsal spine of the 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |
| Intercostal cervicis | Transverse processes of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |
| Longus capitis | Transverse processes of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |
| Longus cervicis | Transverse processes of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |
| Semispinalis capitis | Transverse processes of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |
| Semispinalis cervicis | Transverse processes of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |
| Multifidus cervicis | Transverse processes of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |
| Rhomboid cervicis | Transverse processes of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |
| Interspinalis cervicis | Transverse processes of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |
| Rhomboid posterior cervicis | Transverse processes of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |
| Rhomboid posterior cervicis | Transverse processes of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |
| Oblique superior cervicis | Transverse processes of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |
| Oblique inferior cervicis | Transverse processes of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th | Flexes the head backward and the shoulders |

CASE REPORT

A white male 63 years of age was first seen on February 20, 1928. In August, 1927, he noticed that his head had a tendency to rotate toward the left. This condition gradually became more aggravated until the chin was pulled over as far as the plane of the left shoulder. He was able manually to force his head toward the right until his face looked straight forward, but on releasing this force the neck muscles would immediately contract in a spasmodic manner and pull his face back again to the left. There was no history of any serious infectious diseases and with the exception of a tonsillectomy in 1915 and a frontal sinus operation in 1927 he had never consulted a physician up to the onset of his present disability.

The examination disclosed the typical picture of an aggravated case of spasmodic torticollis. The muscles which seemed to be particularly involved were the right sternocleidomastoid and the left posterior neck muscles. The left shoulder was more elevated than the right, a fact which suggested a certain amount of involvement of the left trapezius muscle. There were in addition periodic spasmodic contractions of the left platysma. The contractions of the left posterior neck muscles were so powerful that it was impossible to determine whether or not there was any involvement of the posterior neck muscles on the right side (Figs. 1a, 2a and 3a).

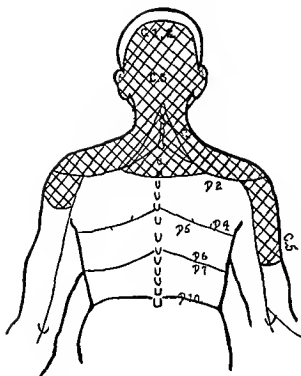
First operation. On February 25, 1928, through an incision on the right side of the neck, the right posterior accessory nerve was divided before its entrance into the sternocleidomastoid muscle, the proximal end of the nerve being untended into the subcutaneous fat in order to misdirect the fibers should regeneration take place.

The result of this procedure was a moderate amount of improvement as far as the spasmodic contractions of the right sternocleidomastoid muscle were concerned, as the contractions were eliminated by paralyzing the muscle.

Second operation. On March 8, 1928, a laminectomy was done by removing the posterior arches of the second to the fourth cervical vertebrae. After opening the dura the second, third and fourth posterior roots on both sides were divided (the first cervical posterior root could not be demonstrated). The first, second and third anterior roots on the left side were also divided so as to paralyze to a large extent the deep posterior neck muscles on the left side.

After this operation there was very marked improvement although the result was not perfect because of spasmodic contractions of the left platysma and a marked elevation of the left shoulder produced by spasmodic contractions of the left trapezius muscle.

Third operation. On September 25, 1928, the patient was again operated upon. The object of this operation being to paralyze the left platysma and the left trapezius muscles. This was accomplished in the following manner: Through an incision along the angle of the left side of the jaw, the lower branches of the facial nerve were demonstrated at the anterior border of the parotid gland. The branch of the nerve which supplied the platysma was then demonstrated by means of faradic stimulation and divided. Through a



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The outstanding features of interest in the case reported and the lessons learned are

1 The presence of an aggravated condition of spasmodic torticollis without any history of encephalitis or other infection except a frontal sinusitis which occurred several months before the onset of the torticollis. If the condition was the result of some toxic or inflammatory lesion of the corpus striatum the sinusitis may perhaps have been the focus of the infection.

2 The necessity of performing numerous neurectomies before spasmodic contractions of various neck muscles could be entirely stopped.

3 The failure of stopping the contractions by interfering with the afferent impulses entering the central nervous system through the second third and fourth cervical posterior roots.

4 The retention of all of the various neck movements in spite of paralyzing so many of the neck muscles by dividing the first second and third anterior roots on the left side and the first second third and fourth anterior roots on the right side.

5 The impossibility of estimating accurately before instituting operative treatment all of the various group of muscles which may be involved in the spasmodic contractions. For this reason numerous operations were required before a complete cure was effected. The writer did not anticipate the fact at the onset that so many operations would be required in this particular case. The involvement of other groups of muscles could be demonstrated only after the elimination of certain groups. The case therefore illustrates the fact that each case of spasmodic torticollis should be studied as an individual problem and such operative measures employed as may prove to be indicated for the individual patient.

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- 1 COLEMAN C C T S th Sug A 97 xx 29 96
- 2 DOWNMAN CHARLES E D phr gmat c tic f l l n e c ph l t i s J Am M Ass 97 l xx 1 95
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EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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DECEMBER 1931

TRANSPLANTATION OF THE URETERS

TRANSPLANTATION of the ureters into the large intestine is a dramatic procedure when considered from any standpoint. Physiologically it is dramatic because it is nothing less revolutionary than the transmutation of the mammalian to the avian type of eliminative system. Technically it is dramatic for the reason that its successful performance depends upon a single principle.

Under all conditions where nature must deliver fluid through a duct from a functioning organ where the pressure must of necessity be low and regular to a muscular reservoir in which the pressure is higher and is irregular, the end is accomplished by a valve mechanism. The only way that nature has made a valve at any point for such a purpose is by running the duct immediately beneath the mucosa of the receiving organ for a distance before entering the lumen of the organ. The success of ureteral transplantation is based upon the surgical construction of such a valve.

Clinically the procedure is dramatic for the reason that any patient whose condition demands transplantation of the ureters is hopeless as far as society is concerned unless a sphincter controlled reservoir for the urine can be established. What is more tragic than that one shall have been consigned to the social ostracism and lifelong personal discomfort engendered by the constant uncontrolled discharge of urine? Nor does it matter whether the condition has been caused by defective sphincter control by ectrophy of the bladder or by incurable fistula from whatever cause.

There is an increasing volume of clinical evidence that a properly constructed valve at the end of a transplanted ureter amply protects the ureter and kidney against intra intestinal pressure and ascending infection. However the mere mechanics of the construction of a valve do not completely cover the field. There are at least two inescapable clinical problems.

Because the kidney is a vital organ as evidenced by the fact that we have two provision must be made for uninterrupted renal function during the process of establishment of competent valves. This may be accomplished in three ways: (a) transplantation of the two ureters at separate operations with an interval of time; (b) nephrostomy or high ureterostomy which provides for temporary loin drainage of urine during convalescence; (c) transfer of the urine through the operative field by means of indwelling tubes or catheters which are fastened in the ureters by constricting ligatures which pass out through the anus to a receptacle and which finally

come away when the intra intestinal ends of the ureters slough

The second important clinical difficulty encountered is infection. In doing this operation the peritoneal cavity is opened. The retroperitoneal connective tissue space is opened. In this same operative field two germ infested sewers so to speak are to be connected.

How to prevent infection is a real clinical problem. Even with the most meticulous technique there is still danger of infection which may result from the operation itself or which may later emanate from the intestinal wound. Occasionally though very infrequently the ureter sloughs outside the intestine from deficient blood supply. An infection which may be so slight as not to produce a serious peritonitis may yet be sufficient to cause postoperative ileus. A slight colon bacillus infection in the undrained retroperitoneal connective tissue space may slowly extend in all directions until the patient dies of chronic sepsis. In order to limit the source of infection the lower segment of bowel is isolated, cleansed and dried so that no germ bearing fluid can escape from the intestinal canal. Moreover in the interest of the greatest possible safety drainage is not only desirable but essential. The retroperitoneal space is filled with a mesh of connective tissue with inter spaces which hold fluid by capillary attraction. This fluid which may become infected will not be drawn from these spaces either by gravity or tube drainage until the spaces become supersaturated or walled off. On the other hand it may be rapidly drawn out by capillary drainage used in the form of gauze. This should be protected by a smooth substance such as gutta serena tissue carefully arranged across the pelvis so that the intestines may not contact the gauze drains.

In the hands of a few skilled operators the original technique requiring two major ab-

dominal operations for transplantation of the ureters has been quite satisfactory for the treatment of exstrophy of the bladder in children and thereby has been the means of furnishing definite proof of the efficacy of the valve. However on account of its danger no operator has had the courage to recommend it for such non fatal afflictions as incurable urinary fistula. Because of the multiplicity of operations and the consequent delay surgeons have not advocated it in such serious progressive maladies as would require elimination or removal of the bladder. The tube technique is applicable in both the classes of cases. In the hands of a surgeon equally skilled in both types of operations the bilateral transplantation by the tube technique is less dangerous than the transplantation of a single ureter by the original technique. Furthermore the patient is spared the additional inconvenience and delay consequent upon multiple separate major abdominal operations.

A skillfully performed operation for bilateral transplantation of the ureters brings inexpressible relief and joy with a reasonably small risk to the patient with an incurable urinary fistula. In cases of obstructing incurable cancer of the bladder or prostate it gives palliation. In a case of incurable tuberculosis of the bladder remaining after nephrectomy performed for unilateral renal tuberculosis transplantation of the ureter of the remaining good kidney gives instantaneous and lasting relief. In cases of inflammatory ulceration or contraction of the bladder it gives relief. In certain cases of advanced carcinoma without demonstrable evidence of remote metastasis transplantation of the ureters followed by destructive doses of radium may be curative. In cases of cancer limited to the bladder wall in women a choice of two methods is available (1) transplantation of the ureters fol-

lowed by destructive doses of radium applied in the open bladder and in the vagina (2) transplantation of the ureters followed a few weeks later by total cystectomy. Transplantation of the ureters and cystectomy at the same operation is not practical in women because of the interposed generative organs.

In man total cystectomy and prostatectomy combined at the same sitting with bilateral transplantation of the ureters has been done successfully in a small number of cases of cancer of the bladder and prostate. The advantage accruing from the opportunity to drain the retroperitoneal space into a large gauze pack placed in the vesical space instead of through the peritoneal cavity seems to compensate to a degree for the extra operation of cystectomy, which is a surprisingly short operation if performed while the abdomen is wide open for the transplantation operation.

In certain cases particularly in young children with exstrophy of the bladder the ureters may not be sufficiently large to admit large size catheters. In such cases the original two stage operation or some modification of it may be used. An alternative method which has been termed the 'Transfixion suture technique' is described in the *Journal of the American Medical Association*, May 31, 1930.

If the results of animal experimentation with this transfixion suture technique are sustained clinically it should supplant the original two stage technique but will still of course have the disadvantage of requiring two operations.

In the hands of a skilled abdominal surgeon transplantation of the ureters is a feasible operation and as such is indicated as a means of relief for all conditions in which it is necessary to dispense with the bladder as a reservoir for urine.

R. C. COFFEY

SURGICAL MORTALITY IN "HARD TIMES"

IN the current business depression people of limited income avoid all unnecessary expenses. Surgical operations other than those of an emergency nature figure almost as luxuries in the financial scheme of the vast majority of the population and are deferred until there is a reasonable assurance that the amount of money that must go to meet hospital charges and the surgeon's fee can be readily replaced in the family bank account. The uncertainty of continued employment, reduction of wages, agricultural conditions, and a general social unrest militate against the somewhat thoughtless faith in the future that we enjoy under ordinary circumstances. As would be expected surgical diseases often of a progressive and debilitating nature are allowed to go without operation until their interference with the capacity to work and their impending threat to life itself assume obvious importance. The direct consequences of these facts are apparent in the surgeon's experience: (1) The total number of patients is smaller than normally. (2) He sees perhaps the same number of patients suffering from diseases which are acute and fulminating in their nature from the start but (3) an increasing number of patients with advanced chronic diseases that have progressed to the point where profound secondary nutritional and degenerative changes have occurred. (4) There is a very considerable reduction in the number of patients presenting themselves for operations at a time when little or no general damage has been done. Normally the group named last makes up the great bulk of general surgical practice that is surgery of election. With the decrease in the number of such subjects for operation the proportion of gravely sick patients rises. Wherever this is the case an increase in

surgical mortality is to be expected and probably occurs. We do not, however, believe that it is inevitably large.

The profoundly sick patient remains the sharpest challenge to our ingenuity and sound thinking, whether his condition be of abrupt onset or the late result of chronic disease. We are here principally concerned with the latter situation. A thorough evaluation of the sick person, not simply diagnosis of his underlying surgical disease, is of fundamental importance. The patient with badly depleted salt and water reserves, increasing nitrogen retention, severe anemia, and other indications of profound disturbances of metabolism is for the present a dying patient and is not a subject for operation. He is not a surgical patient at all. He may become one if he can be restored to a reasonable physiologic status by measures that are on the whole strictly medical. The only conditions in which the saving of life may depend on immediate intervention are hemorrhage and suffocation. Confining ourselves again to the patients seen late in a

chronic disease amenable to surgical treatment, they must be considered as only potentially subjects for operation. The ideal toward which we would like to work is restoration to a state of health before performing an operation. While this is theoretically possible in certain diseases, as in a full remission of thyrotoxicosis, it is not often either possible or practical. We estimate the probable future course of the disease and try to attain our ideal of operating on fairly healthy persons. Upon the wisdom of our compromise depends the outcome. It means a nice estimation of how much the patient can withstand at a time and often a division of radical operations

into suitable stages, a sufficient time being allowed to elapse between them for attaining all the benefit to be derived from previous steps. Repeated hospitalization may be necessary in order to avoid severe taxes on the patient's reserve at too frequent intervals. We are prone to forget that an incomplete or a palliative operation is preferable to a dead patient.

Finally, we shall more frequently have to refuse entirely to operate. It is a common saying that surgical mortality is 90 per cent patient and 10 per cent surgeon; its seed of truth is most apparent to those who have a physician's share of humility. We take the point of view that we are unwilling to assume a risk for another person that we should be unwilling to take for ourselves, but would carry it even farther than that and insist that there be a reasonable chance that the patient will not die as a result of our operation. When we have said, "This patient is in as good condition as we can get him," therefore we must do something. We have been guilty of loose thinking. Because there is less surgical work to be done by most of us at present, it is particularly easy to take unreasonable risks on the poor-risk patients who make up so large a percentage of those seeking our help. To do so will inevitably give all surgery a black eye and will in better times hold away from the surgeon many whom he could restore to health. It took centuries for surgery to be regarded as anything but a last resort. Let us take care not to prejudice the measure of public confidence which has been gained in surgery that made possible the recent growth of surgery of election.

WILLARD BARTLETT, JR.



JAMES B EAGLESON
1862-1928

MASTER SURGEONS OF AMERICA

JAMES BEATTY EAGLESON

IT is indeed rare for a medical man to attain a high position in his profession as well as in the community in which he lives without acquiring at least a few enemies. Dr. Eagleson was universally loved and respected by the medical profession and laity. Although he held a most enviable position at home and abroad in his chosen profession, his honors came to him unsolicited. He never stooped to petty political methods for self advancement. His association with his colleagues was always guided by high ideals in the keen competition which naturally confronted him in a city.

Dr. Eagleson was born in Chillicothe, Ohio, in 186 and was graduated from the College of Physicians and Surgeons of Chicago, Illinois, in 1885. He came to the Pacific Coast soon after graduation and located at Port Townsend, Washington, where he was attached to the staff of the United States Marine Hospital. He moved to Seattle in 1887 and was connected with the United States Public Health Service for several years. On his arrival in Seattle he took up the general practice of medicine but in later years confined himself entirely to the practice of surgery, one of the first men on the Coast to do so.

He was universally recognized as a conservative and skillful surgeon of keen judgment. During the course of his career he enjoyed a large general surgical practice, performing every conceivable operation that a general surgeon is called upon to do, being especially proficient in herniotomy in his early days because of his association with Public Health Service.

He was one of the pioneers in operating for congenital pyloric stenosis in infants. At that time the operation of choice in such cases was posterior gastroenterostomy. He reported a series of cases with very good results.

While he did all of the surgery he undertook very well, yet in the later years of his life he confined himself to gynecology and general abdominal surgery.

As a recognition of the very high esteem in which he was held by his colleagues, he was frequently called upon to operate on physicians and physicians' families, and he never failed to respond to the call of a colleague in distress.

Dr. Eagleson was one of the founders of the American College of Surgeons and was chosen one of its regents. He served faithfully and efficiently in this capacity until his death.

He was one of the first surgeons to suggest the holding of surgical clinical congresses in the big centers for the benefit especially of the surgeons in outlying districts. Through his frequent visits to the large clinics he recognized the importance of observing the work in the clinical surgical centers to keep abreast of the times.

Over thirty years ago he was one of a small group of medical men who determined that a medical library was a necessity for the profession in Seattle. Accordingly with a small group of medical men he founded the Seattle Medical Library Association and he himself wrote the articles of incorporation. For many years the books as they accumulated were stored in his home. His personal library contained many rare and valuable books as well as a large collection of modern works.

Early in his career he took an active part in medical military affairs and at one time he served as surgeon general on the staff of the Governor. When the United States decided to participate actively in the Great War he began to look about for an opportunity to render his services to the cause of his country. When it was determined that Seattle should organize and equip a base hospital he was entrusted with Base Hospital No. 50.

During its development and his active service in France he endeared himself to the doctors, nurses and the entire personnel of the unit. For his conscientious and splendid work in the Great War he was promoted to the rank of Lieutenant Colonel and was made a Chevalier of the Legion of Honor.

Unfortunately a great sorrow awaited him on his arrival in New York from France. He was called at once to Norfolk, Virginia, on account of the serious illness of his only son, Lieut. James B. Eagleson, Jr., returning from France about the same time on a different steamer when he contracted influenza. Dr. Eagleson arrived at his son's bedside only two days before he passed away.

Dr. Eagleson, from his Scotch Irish ancestry, inherited qualities of uprightness of purpose with firm religious convictions which characterized his whole life and identified him as a typical Christian gentleman. He was a prominent church worker and for many years served on the governing board of the Young Men's Christian Association. One of his firmly fixed principles was his opposition to the use of alcoholic beverages and he advocated total abstinence. One of Dr. Eagleson's outstanding traits was his tolerance for the actions and opinions of others. While he had his own firm convictions he never sought to impose them on his associates.

Twenty years ago as a member of the Charter Committee he worked arduously for many weeks on the problems connected with revising the City Charter. Later he also did excellent work on committees pertaining to health and sanitation of his home city and state.

Besides his leadership and membership in a number of local medical societies

he was president of the King County Medical Society and president of the Washington State Medical Association and the North Pacific Surgical Association. He was also a member of the American Society for the Advancement of Science the American Academy of Political Social Science and medical director of the Northern Life Insurance Company.

At the onset of his fatal illness in his sixty fifth year he was actively at work probably as busy as at any time in his years of practice. After a short illness just as he had wished that his earthly career might be terminated while still in active practice he passed away on January 26 1908. Dr. Eagleson well deserves to be known as a great personality. In our memory he lives as a leader in the medical profession a worthy citizen and an invaluable friend. O. F. LAMSON

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

ALFRED BROWN M.D. F.A.C.S. OMAHA

THE WAR WOUND SURGERY OF ROTA

MEDICINE and surgery as do all other line of human endeavor run to phases representing rising and falling interest in some particular subject. Some of these phases may properly be called fad or fancies but not all for in an occasional instance the subject occupying the medical or surgical foreground has a real interest and its temporary dominance results in considerable addition to the knowledge of the subject under discussion. These phases as they occur are pabulum for the writers and hasten to publish a monograph or book on the subject in order to show that he is up with the precession and to keep himself and his university in the foreground of the medical picture. It is naturally to be supposed that many of these books present little if anything new and many of them are frankly plagiarized from their predecessors.

Rota's book on war surgery falls into this class. He lived during the middle part of the sixteenth century at Bologna from whose University he had received the degrees of doctor in both philosophy and medicine. He had become a well known and learned anatomist and had been awarded with the chair of surgery which he held up to the time of his death in 1558.

In addition to his duties as professor of surgery, Rota was physician to the surgeon to the papal army and had the opportunity which he tells us to see war surgery in the fighting around Parma and Mirandola during the constant warfare then going on. Consequently when he saw Guido Guidi in 1544 Magg in 1552 and Ferri in 1552 publishing books on the surgery of wounds he decided to do likewise and in 1555 at Bologna his book first appeared under the title *de bliscis in to m i n u t i s e r i b u s e r u n g e c i a t i o n e l i b e r*. The title is misleading for from it one would not know that gunshot wounds are even considered for treatment as instruments for throwing missiles by mechanical power similar to the old Roman ballista or crossbow for shooting stones and darts or the larger catapult but be evidently included the newer arquebus in this category as he did not mention gunshot wounds specifically in his title but discussed them in the text. In the later work published in Antwerp in 1583 twenty five years after his death the title is changed and is more specific as to the type of wound of which he writes for it reads *A Book Concerning the Nature and Curation*

of Wounds by Hurling Engines (Tomella rum) Arquebusses by the author Io Francesco Rota of Italy. At Antwerp from the publishing house of Arnold Coninx 1583. It would be interesting to know definitely who changed the title though we may assume it was the publishing house of Coninx which published the three great wound treatises of Fern Rota and Botallio in one volume. The titles however of the books of Fern and Botallio are not changed but that of Rota's book is though at the beginning of the book itself the original title appears exactly as it did in the edition of 1555. Evidently the whole thing was thought about by the desire for uniformity in the three works.

Rota's work represents the best up to that time and there is no reason why it should not as he had had not only the opportunity of actual experience in the observation and treatment of wounds in the army but also the opportunity to read and study the works of his predecessors in this field. That he had done the latter is self evident from the manner in which he plagiarizes the work of Magg. Though he thus plagiarizes and also freely borrows the ideas of John da Vigo and Alfonso Ferri he never mentions them and so runs true to the form of the majority of the writers of his time whose custom it was to give all credit to the ancients. Thus Rota does freely and frequently refer to Hippocrates, Galen and Celsus occasionally to the Arabians and Paulus of Aegina but does not refer to anyone more modern than the Arabians.

This custom of the writers of the Renaissance probably held medical and surgical progress back to a considerable extent. Instead of giving us a picture of a group of men working in co-operation and trying to help each other we see individuals scattered over all of Europe each in his own little town or university working on the problem in which he is interested and using though not giving any credit to the work of his contemporaries or even his near predecessors.

Rota's work suffers as does the work of Magg in which he plagiarizes from the fact that he accepts Magg's dictum that gunshot wounds are in themselves poisoned and all his diagnosis and treatment is based on this assumption. The fact that the wounds were all infected is probably true and consequently the treatment was the better then known but as a matter of scientific fact the assumption that the origin of the poison lay in the causative agent (the gun powder) was incorrect.

DE TORMEN-
TARIORVM SIVE AR-
CHIBVSORVM VVLNE-
RVM NATVRA ET CVRA
TIONE LYBIA

AVTHORE
IO FRANCISCO ROTA
ITALO



ANTVERPIÆ,
Ex officina Arnoldi Coninx.
M. D. LXX XIII

REVIEWS OF NEW BOOKS

THE theories of bone formation and bone absorption especially in terms of modern biochemistry are reviewed by Greig in his recent book.¹ Greig has studied an extensive museum material with the idea of attempting to explain morphological changes in terms of pathological physiology. The theoretical considerations are inadequately handled and are not based on sufficiently sound observation and experiment. The pathology of osteomyelitis and tuberculosis of bones is fully discussed and particularly well illustrated from museum specimens. The book would have been improved by supplementing the photographs by roentgenograms of some of the specimens. A chapter on secondary involvement of bone by malignancy is not very extensive. The illustrations of traumatic ossifying myositis or traumatic osteoma are particularly good.

D. B. PRUMSTER

THE *Collected Papers* of Edwin Beer reflect his many surgical and medical interests but deal principally with problems of the genito-urinary tract.

The papers in which he deals with the treatment of bladder tumors with high frequency current are interesting and important. This is true because the author is the pioneer of the procedure and describes the technique minutely. It is surprising to read that Dr. Beer was told by manufacturers of instruments that his idea was impractical yet he toiled until he perfected our modern treatment of vesical neoplasms with high frequency current through the cystoscope.

For carcinoma of the neck of the bladder Dr. Beer is an advocate of complete cystectomy, partial or total prostatectomy and vesiculectomy with implantation of the ureters to the skin provided the adjacent pelvic lymph glands are not involved. He believes that the implantation of ureters into the large bowel is not yet practical.

He describes minutely several procedures for which he will be remembered. One of these is the use of fat to prevent sutures cutting into parenchymatous organs by undermining. He stresses roentgenographic evidence of obscure perinephritic abscesses. Functional tests of the kidneys, lime deposits in the kidneys and cystic changes of the kidneys are all reviewed.

Because of his large experience, Dr. Beer's ideas and judgment are well worth reading, especially by genito-urinary specialists.

HARRY CULVER

THE first 170 pages of *Handbuch der Urologie*² were written by Professor Lichtenberg. He dis-

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cusses general urologic symptoms and diagnoses in the first half and X-ray diagnosis in the second half. Professor Lichtenberg emphasizes the importance of a careful complete history and physical examination even though the case may appear to be purely a urologic problem.

Forty pages were written by L. Casper and P. F. Richter on kidney function and its relation to surgical intervention. The importance of Koranyi's work on cryoscopy of the blood and urine are emphasized as important points in determining renal reserve and in evaluating surgical risk.

Professor O. Ringleb discusses clearly urologic technique. The section on general therapy in diseases of the kidneys and ureters is written by Professor H. Bruct. The last section by Professor H. Holthausen covers the use of light rays, X-rays, etc. The technique and its use in special conditions such as tuberculosis, actinomycosis, gonorrhea, prostatic hypertrophy, and tumors of the genito-urinary tract are reviewed. There is a full bibliography at the end of each section.

M. HERBERT BARRE

THE fourth edition⁴ of Professor Zinsser's classical lectures on immunology is entitled *Resistance to Infectious Diseases* instead of *Infection and Resistance*. The newer advances made in the 8 years since the former edition are included and evaluated. One is impressed as usual with the straightforward style of the author and his ability to state problems and results in simple, clear language. The book has two main divisions: one the principal mechanisms of resistance and two special problems in immunology. Bacteriological and diagnostic techniques are not described in detail. This work continues to be an authoritative review of immunology.

PAUL STARR

THE author of *Breast Feeding*⁵ displays a great knowledge of her subject gained both by practical observation and study. It is written concisely and well. The prenatal care of the breasts, diet of the mother, mechanics of breast nursing, methods of assisting the baby at the breast, is quite complete and includes only accepted facts, not theories. This much of the book can be read with profit by anyone dealing with mothers both before and after the arrival of the infant. These first fifty-six pages are alone worth the price of the book. From this point on the author digresses so far from American practices and beliefs that it could not be recommended to mothers without reservations. Specifically the use

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of calomel and gray powder for diarrhoea the belief that an infant should never be assisted by enema or suppository in habit constipation should not be given a supplementary bottle to accustom its digestion to cows milk and relieve the mother occasionally the postponement of cereals milk and vegetables until a young time can hardly be substituted by American physicians. These chapters however contain many valuable ideas and are not to be condemned because of these variations from our more common practices. The book on a whole can be used as a supplementary text in nurses classes medical lecture and classes and can be read with interest and profit by physician dealing with mothers and infants.

GERARD N. KROST

GERARD N. FROST

FOUR volumes of the Lewis *Practice of Surgery*
are discussed at this time

The material on bones and joints has been extended from volume II to volume III. Volume III also contains chapters on tendons, ganglia, muscles and fascia, peripheral nerves, brachial palsy, the urgency of the autonomic nervous system, diseases of the lymphatics and amputations. The general scheme of dealing with subject matter is adhered to in this volume.

The reader should be warned that the chapter on tendons and fascia does not include the surgery of the hand which appears in volume v the subject matter in volume ii covering general principles and surgical technique. The chapters on the surgery of the peripheral nerves and on brachial plexus although not extensive are commendable in that diagnostic methods as well as technique are stressed. The autonomic nervous system is described in considerable detail and that interesting but little known subject sympathetom is discussed. For the neurologist the material may be insufficient but the general surgeon will find much aid and information in a concise form. The chapter on the lymphatics is very complete and to an extent speculative yet it is pleasant to observe a note of optimism. The chapter on amputations is perhaps the outstanding one in this volume due chiefly to the fact that rather as is laid on general principles. Modern prosthesis is described and emphasis is placed upon the proper stump for best functional result.

From the reviewer's viewpoint the pre-eminent chapter in volume iv is that written by Bloodgood on the surge of the mouth and jaws. Malignant disease of the head of the physician as well as the layman is commonly encountered in the oral cavity. The author states that if the patient consulted be a physician in the very incipency of the lesion and the

physician properly cared for his patient no case would succumb to malignancy. This chapter is a bit of refreshing information regarding carcinoma and should be of vital interest to all practitioner of medicine and dentistry.

The surgery of the eye ear nose alivar gland pharynx and larynx are d scussed in an adeqate but of recessity brief manner

The progressive trend of modern surgery is well illustrated in the fact that 710 pages in volumes IV and V are devoted to the thoracic cavity and its contents. The subject is covered in an unusually complete and descriptive manner. The physiological aspects of the lungs are ably discussed by Graham. The oesophagus, injuries to the chest, emphysema, mediastinal infections, surgery of the heart and pericardium, the surgery of pulmonary tuberculosis, pulmonary abscess, bronchiectasis, massive collapse of the lung, tumors and cysts of the thorax, the breast and diaphragm are treated with clarity and detail. In reviewing these chapters one is impressed with the endless enthusiasm and resourcefulness of the authors. It is clearly demonstrated that the surgery of the thorax is being rapidly and scientifically planned. Much of the work on the heart and pericardium may be of academic interest only but it can be of no more academic value now than was lung surgery 20 years ago. Yet today as is so clearly demonstrated by Hedblom, Heuer, Archibald and others in the remarkable articles, lung surgery is on a sane and practical basis.

Volume v further contains a chapter on plastic surgery by Davis. In the main this considers general principles and is well constructed. Congenital cleft lip and palate are also discussed. A chapter of approximately 350 pages devoted to the hand is perhaps from the practical viewpoint the distinctive chapter of the volume. Every conceivable condition is discussed. If an deficiency can be conceived it may be that of the correction of the deformed hand which is an art unto itself. One cannot but feel a sense of disappointment in going over this subject material and find no mention of the man who has been a pioneer in the scientific study of the hand and who has placed the subject on a sound scientific basis.

In volume vii are found chapters on surgical diseases of the pancreas, appendix, colon, malformations of the colon, surgery of the rectum and anus, intestinal obstruction or ileus, surgery of the peritoneum and hernia. Archibald's discussion of the pancreas is most interesting. It is known that the author has been much interested in this subject and has carried out extensive experimental work, which coupled with his rich clinical experience, makes him eminently competent to present the subject. David presents the surgery of the rectum and anus in a clear and concise manner. The chapter is well written and is perhaps the most valuable contribution in this volume. He clearly illustrates the necessity of careful routine examination of the patient and the ease with which most diagnoses can be made. He also

impresses upon the reader the ease with which an error can be made when a careful examination is not made

In Hartwell's presentation of intestinal obstruction the most interesting and valuable part to the well trained surgeon is the classic review of the experimental work that has been done. The author weighs all the evidence and places it before the reader in such a manner as can be done only by one who thoroughly understands the subject. His analysis is keen and judicious.

These four volumes make an attractive addition to a surgical library since a tremendous amount of information is assembled under four covers. Many articles are accompanied by a comprehensive bibliography.

J A WOLFE

A WELCOME addition to that section of our library which deals with injuries and their treatment will be found in Heald's *Injuries and Sports*. The book is very well written, the sequence of the subject is excellent, the illustrations are very interesting and perfectly executed. The author has had an enormous experience and evidently has been highly successful in the treatment of this particular type of injury. It is the best book on the subject that the reviewer has ever seen. It contains 380 illustrations. The two manikin charts on the inside cover and fly leaf which serve as indices are both novel and practical. The author emphasizes the value of anodal galvanism and the Smart-Bristow coil.

The plan of the book is based upon the division of

the body in regions. The book contains the best discussion of the subjects of tennis elbow and rider's muscle that the reviewer has seen. The author has chosen excellent material from the literature. The work of Sir Robert Jones is conspicuous by its absence.

The publishers performed their part very well. The book should be in the library of every orthopedic surgeon, athletic director and those who are called upon to treat injuries.

PHILIP LEWIN

THE Mayo Clinic monograph on Addison's disease by Rowntree and Snell is one of the most important publications of the year. The study begins with an historical sketch of the knowledge of the adrenal glands and includes a reprinting of Addison's original description of the disease. The clinical histories and autopsy records of 31 cases are then presented and analyzed. Eleven more cases clinically typical but without autopsy confirmation are then given and following these are 17 atypical case histories. A third group of 17 cases is still under observation. The clinical histories of these are given. The succeeding chapters (about one half the monograph) discuss the signs and symptoms, laboratory data, differential diagnosis, complications, prognosis and treatment, including the recent results with the cortical hormone of Swingle and Pfaffen. There are good illustrations and a number of graphs. The discussion is detailed, gives weighted emphasis to the characteristics of the clinical picture and produces the impression of great familiarity with this disease.

PAUL STARR

I N J U R I E S A N D S P O R T S. A G E N T A L G U I D T O T H E P R A C T I C I O N E R. By C B Heald, G B F M A, M D (C a t b) M R C P (L o d) L o n d. 4 N W Y & O n f d U. 1933.

* M A C R I T M n A C R I T S n A d o D f By Leo d G R w l r M D d A l b t M s l l M D P h d d l p h d L o d W E S s d C o m p y g

BOOKS RECEIVED

Books received are acknowledged in this department and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

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CORRESPONDENCE

INTERNATIONAL GYNCOLOGICAL CONGRESS

The Editor The Council of the American Association of Obstetricians Gynecologists and Abdominal Surgeons proposes that an International Gynecological Congress be held in the late summer of 1933. The undersigned have been appointed to act as a Committee and would be pleased to learn from their colleagues here and in other countries whether such a proposal is agreeable and where could be the best place to hold the Congress in order to assure the largest attendance. The time proposed is the last week in August or first week in September of 1933.

Anyone interested is requested to address the secretary, Dr. Arthur Stein, 935 Park Avenue, New York.

The Committee: WILLIAM SEAMAN BAINBRIDGE, M. D., chairman; LOUIS E. PHANEUF, M. D., and ARTHUR STEIN, M. D., secretary.

INTERNATIONAL HOSPITAL ASSOCIATION

The Editor At the close of the Second International Hospital Congress which met in Vienna

Austria from June 8th to 14th 1931 the representatives of the 41 countries participating voted unanimously to organize an International Hospital Association.

The purpose of the Association is to bring about an international exchange of opinion and international co-operation in all problems and in all fields of hospital work and in all relationships—economic, sociological and hygienic.

Anyone interested in this work and in the betterment of hospitals throughout the world will receive full information by addressing the undersigned or any member of the Executive Committee as follows: Dr. W. Alter, Geh. Reg. und Med. Rat, Moorenstrasse 5, Düsseldorf; Dr. H. Frey, Direktor des Inselspitals, Freiburgstrasse 42, Bern; Dr. A. Gouachon, 56, Passage de l'Hôtel Dieu, Lyon; Dr. I. P. Kinloch, Chief Medical Officer, Department of Health, Edinburgh; Prof. Dr. E. Ronzani, Direttore, 2, Piazzale Lavater, Milano; Prof. Dr. J. Tandler, Amtsfuehrer Stadtrat, Rathausstr. 9, Vienna.

Dr. RENÉ SAND, *President*, Avenue Velasquez 2, Paris 8e.
 Dr. E. H. L. CORWIN, *Secretary*, 634 1st St., New York 1.

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